NORTH CAROLINA GEOLOGICAL SURVEY.

J. A. HOLMES, STATE GEOLOGIST.

BULLETIN No. 3.

GOLD DEPOSITS OF NORTH CAROLINA.

BY

HENRY B. C. NITZE

AND

GEORGE B. HANNA.

WINSTON:
M. I. & J. C. STEWART, PUBLIC PRINTERS.
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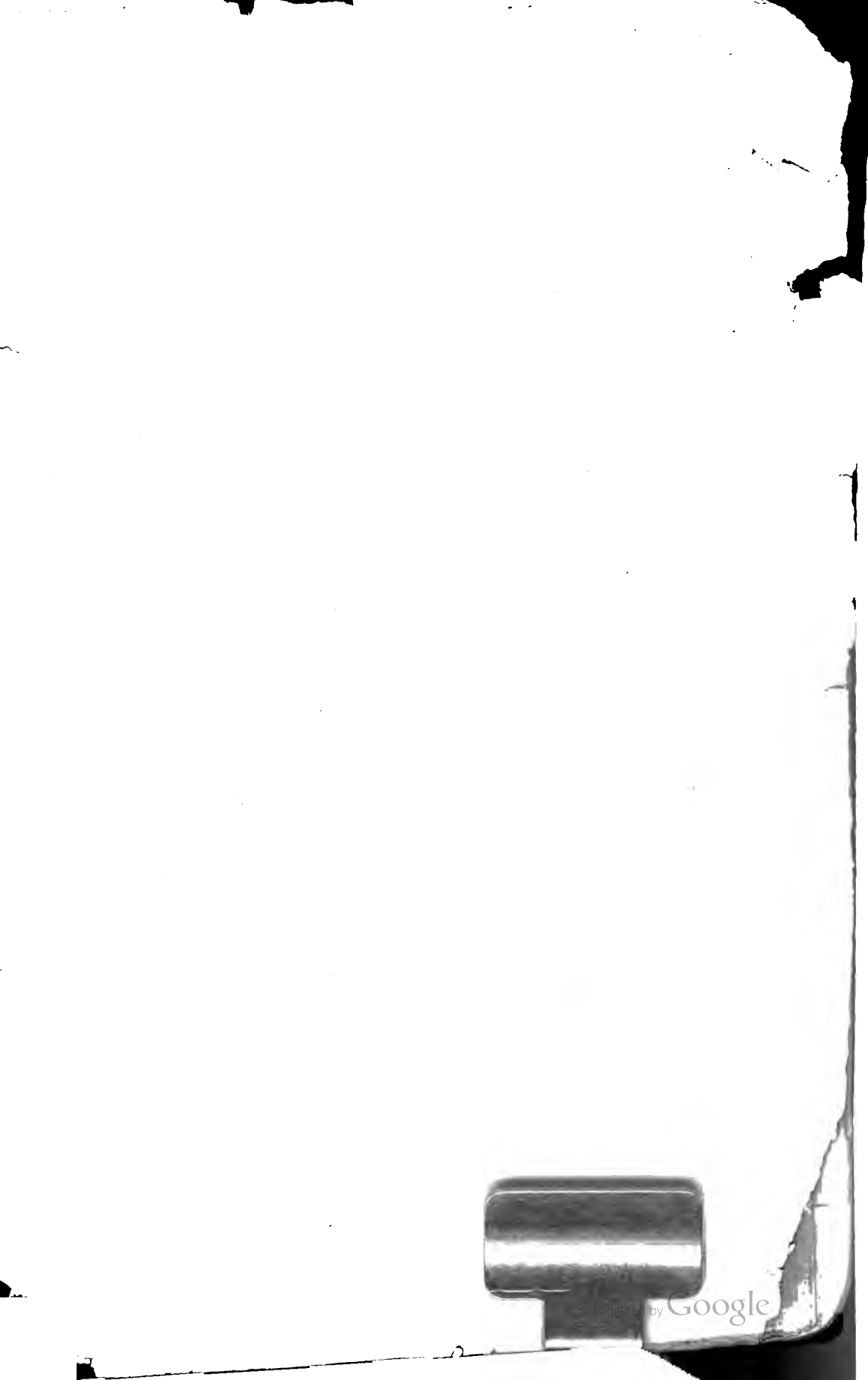

PARTIAL LIST OF GOLD MINES

LOCATED ON THE ACCOMPANYING MAP OF NORTH CAROLINA.*

1. Portis mine, Franklin county.
2. Mann-Arrington mine. Nash county.
3. Arrington mine, " "
4. Roberson mine, Orange "
5. Belle mine, Moore "
6. Burns mine, " "
7. Cagle mine, " "
8. Clegg mine, " "
9. Brown mine, " "
10. Hoover Hill mine, Randolph "
11. Wilson Kindley mine, " "
12. Jones mine, " "
13. Parish mine, " "
14. Davis Mt. mine, " "
15. Sawyer mine, " "
16. Winslow mine, " "
17. Uharie mine, " "
18. Emmons mine, Davidson "
19. Cid mine, " "
20. Silver Hill mine, " "
21. Silver Valley mine, " "
22. Conrad Hill mine, " "
23. Welborn mine, " "
24. Russell mine, Montgomery "
25. Appalachian mine, " "
26. Steele mine, " "
27. Riggon Hill mine, " "
28. Beaver Dam mine, " "
29. Moratock mine, " "
30. Reynolds mine, " "
31. Carter mine, " "
32. Sam Christian mine, " "
33. Haithcock, Hearne and Lowder mines, Stanly "
34. Crawford mine, Stanly "
35. Parker mine, " "
36. Barringer mine, " "
37. Gold Hill mines, Rowan "
38. Rocky River mines, Cabarrus "
39. Buffalo mines, " "
40. Nugget mines, " "
41. Crowell mines, Union "
42. Long mines, " "
43. Moore mine, " "
44. Stewart and Lemmonds mines, Union "
45. Crump and Butterfield mines, Union "
46. Henry Phifer mine, Union "
47. Fox Hill mine, " "
48. Black mine, " "
49. Smart and Secrest mines, " "
50. Moore Hill, Folger Hill, Davis, Phifer, Lewis and Hemby mines, Union "
51. Bonnie Bell mine, Union "
52. Howie mine, " "
53. Hamilton and Cox mines, Anson "
54. Hodges Hill mine, Guilford "
55. Fisher Hill and Millis Hill mines, Guilford "
56. Twin mine, Guilford "
57. North Carolina mine, Guilford "
58. Gardner Hill mine, " "
59. North State and Lindsay mines, Guilford "
60. Deep River mine, Guilford "
61. Lalor and Loftin mines, Davidson "
62. Eureka mine, Davidson "
63. Negus, Harrison, Hill, Southern Belle, Goodman and Randleman mines, Rowan "
64. New Discovery mine, Rowan "
65. Dunn Mt. mine, " "
66. Reimer mine, " "
67. Bullion mine, Rowan county.
68. Gold Knob mine, " "
69. Dutch Creek mine, " "
70. Phœnix and Barrier mines, Cabarrus "
71. Faggart mine, Cabarrus "
72. Barnhardt mine, " "
73. Tucker mine, " "
74. Quaker City mine, " "
75. Reed mine, " "
76. Pioneer Mills mines " "
77. Davidson and Point mines, Mecklenburg "
78. Rudisil mine, Mecklenburg "
79. St. Catharine mine, " "
80. Smith and Palmer mine, Mecklenburg "
81. Taylor mine, Mecklenburg "
82. Trotter mine, " "
83. Clark mine, " "
84. Parks mine, " "
85. Brawley mine, " "
86. Todd mine, " "
87. Arlington mine, " "
88. Stephen Wilson, Gibson and Neal mines, Mecklenburg "
89. Capps, McGinn and Means mines, Mecklenburg "
90. G. C. Cathey, Sloan and Chapman mines, Mecklenburg "
91. Dunn mine, " "
92. Henderson mine, " "
93. Ferris mine, " "
94. Hunter mine, " "
95. Tredinick mine, " "
96. Ray mine, " "
97. Simpson and Black mines, Mecklenburg "
98. Ellington, Surface Hill, Ferguson Hill, etc., mines, Mecklenburg "
99. King's Mt. mine, Gaston "
100. Crowder's Mt. mine, Gaston "
101. Rhodes mine, " "
102. McLean mine, " "
103. Duffie, Robinson, Derr, etc., mines, Gaston "
104. Burrell Wells mine, Gaston "
105. Oliver mine, " "
106. Long Creek mine, " "
107. Graham mine, Lincoln "
108. Shuford mine, Catawba "
109. Maiden mine, " "
110. Rufty mine, " "
111. Abernathy mine, " "
112. Butler mine, Davie "
113. Callahan Mt. mine, Davie "
114. Isaac Allan mine, " "
115. Clarksville mine, " "
116. Fulton mine, " "
117. Dixon mine, Yadkin "
118. Hancock mine, Burke "
119. Carolina Queen mine, Burke "
120. J. C. Mills mine, " "
121. Marion Bullion mine, McDowell "
122. Vein Mt. mine. " "
123. Alta mine, Rutherford "
124. Ellwood and Leeds mines, Rutherford "
125. Brown Mt. mine, Burke "
126. Baker, Bald Knob, Pax Hill, Scott Hill, &c., mines, Caldwell "
127. Bee Mt. mine. " "
128. Flint Knob mine, Wilkes "
129. Copper Knob mine, Ashe "
130. Boylston mine, Henderson "

*The symbols and numbers for the mines are printed on the map in red.

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CHAPTER IV—*Continued.*

CHAPTER V—*Continued.*

CHAPTER VII—*Continued.*

ILLUSTRATIONS.

LETTER OF TRANSMITTAL.

RALEIGH, N. C., Nov. 30, 1895.

To His Excellency, HON. ELIAS CARR,

Governor of North Carolina.

SIR:—I have the honor to submit for publication as Bulletin 3 of the Geological Survey, a preliminary report on the Gold Deposits of North Carolina; prepared by Mr. Henry B. C. Nitze, of the Geological Survey, and Mr. George B. Hanna, of the U. S. Assay office at Charlotte. There are many enquiries for information concerning the gold deposits of the State, and in response to these I recommend the publication of this Bulletin.

Yours obediently,

J. A. HOLMES,

State Geologist.

PREFACE.

This preliminary report owes its appearance to the fact that during the past few years there has been a growing interest in the South Appalachian gold fields, and the resulting inquiries have shown that mining operations in many portions of this region are in an exceedingly unsatisfactory condition, and that there were but few publications to be found relating to the subject,—and these of a somewhat unsatisfactory character.

With a view of helping to remedy, as far as might be possible this state of affairs, a preliminary investigation was undertaken by the United States Geological Survey, of this gold region as a whole, and investigations have also been undertaken by the Geological Surveys of several of the states included in this area. Results of the investigations undertaken for the U. S. Geological Survey by Mr. Geo. F. Becker, and the preliminary results obtained by the State Survey in Alabama have been published. Several years ago (1887) a paper on the gold deposits and mines in North Carolina was also published, but this discussion of the subject is now nearly out of print.*

During the past two years a study of the North Carolina gold fields has been made by Mr. H. B. C. Nitze of the State Geological Survey, and by Mr. Geo. B. Hanna of the United States Assay Office at Charlotte, at such times as he could be absent from his duties there. The extent and nature of their work is described in more detail below. During the past year Mr. Nitze, assisted by Mr. H. A. J. Wilkens of Baltimore, has visited practically all of the mines now in operation in the South Appalachian gold field for the purpose of studying the mining and metallurgical methods in use. A statement of the results of their investigations was presented at the Atlanta meeting of the American Institute of Mining Engineers (October, 1895), and is now being printed in the Transactions of the Institute. A more elaborate report by them on this subject will be shortly published as one of the bulletins of this survey.

*"The Ores of North Carolina": being chapter 2 of the 2nd volume of the Geology of North Carolina, by W. C. Kerr and Geo. B. Hanna, Raleigh, 1887. pp. 233-359.

With a view to the preparation of the present report on the Gold Deposits of North Carolina, Mr. Nitze began field explorations in the spring of 1894. During the latter part of May and June some preliminary examinations were made in Stanly, Rowan, Cabarrus, Mecklenburg, Gaston, and Chatham counties. From the end of June to the beginning of November field work was pursued in the South Mountain region, embracing the counties of Burke, McDowell and Rutherford. This work was also extended into Henderson, Caldwell and Wilkes counties.

During the month of November, Mr. Nitze was accompanied by Mr. Geo. F. Becker, and the latter's assistant, Mr. C. W. Purington, of the U. S. Geological Survey, on a reconnaisance trip through Union, Cabarrus, Rowan, Montgomery, Davidson, Randolph, Moore, Chatham, Franklin and Nash counties. During the winter of 1894–'95 he was engaged in writing up the results of his field work, and in making a petrographic study of a number of rock specimens collected in the course of the field explorations. This work was pursued at the offices of the U. S. Geological Survey in Washington, D. C., where he had the cordial assistance of Mr. Becker and his associates.

The time in which it has been necessary to prepare the report of his work, together with other duties, did not allow of a microscopic examination of all the specimens collected, and some work still remains to be done in that direction. During the summer of 1895, investigations were continued in the field, prior to the final writing of this report.

Mr. Geo. B. Hanna, of the U. S. Assay Office at Charlotte, prepared a complete revision of the section on Gold Ores in "The Ores of North Carolina," and has added in this revision the results of his field observations in the gold belts made during the past few years.

In order to bring together all the available data concerning the several gold bearing regions, it was necessary to combine these two reports, and this somewhat difficult task was assigned to Mr. Nitze, who has brought together the subject matter of the two manuscripts in such a way as to present the most logical arrangement of the subject. In the report as published, the geological descrip-

tions and discussions are solely his. The descriptions of the mines are in part his, in part Mr. Hanna's, in part a consolidation of the statements of both.

Many of the facts contained in these descriptions, relating to the old mine workings, thickness of the ore bodies, etc., have been obtained from the personal statements of superintendents of the mines, foremen, miners, etc., and the authors do not hold themselves responsible for these. The majority of the mines described are not in active operation; most of them being at the present time in an abandoned and inaccessible condition. Unless otherwise stated in this report, the mines described are not now being worked.

It is well known that assays of gold ores are of little importance as showing the working value of an ore body, unless very large quantities can be properly sampled in a sampling works, of which there are none in the South. The readers are, therefore, warned not to be misled by assays that are given in this report; they are given to show comparative approximate values, or variations in different parts of the same ore body. Though it ought to be said that, excluding the high grade assays, many of the samples represent fairly well actual ore bodies of greater or less magnitude. The only safe criterion of the value of an ore is a mill test.

Unless otherwise stated, the assays given in this report, have been made by Mr. Hanna. The gold and silver have been valued at their coining rates, viz: Gold $20.67 per fine ounce, and Silver $1.293 per fine ounce. This is plain as to gold, for the coining and commercial rate are practically the same; but with silver the commercial rate varies greatly, and those who are especially interested must correct the stated valuation by the commercial rate of the day. The ton mentioned in the assays is invariably 2000 pounds.

Mr. Chas. E. Cooke, topographer, of the U. S. Geological Survey, was engaged from October 10th to the latter part of November in revising the S. W. quarter (250 square miles) of the Morganton Atlas sheet, on a scale of one mile to the inch, with contour intervals of 50 feet. The map of the South Mountain region published in this report (plate XII) is the result of Mr. Cooke's excellent survey.

J. A. Holmes.

THE GOLD DEPOSITS OF NORTH CAROLINA.

By H. B. C. NITZE AND GEO. B. HANNA.

CHAPTER I.

THE GOLD-PRODUCING AREA AND ITS DEVELOPMENT.

The area of the gold-bearing rocks; historical notes; gold and silver production in North Carolina; character and fineness of the gold and silver; the gold-bearing rocks; nature of the ore deposits.

AREA OF THE GOLD-BEARING ROCKS.

The formations of about one-half of the area of North Carolina may be considered as gold bearing, but the productive part of this area, i. e. the part which at one or another period has been exploited to any considerable extent will not exceed 8,000 or 10,000 square miles. There are at least 350 localities in the State which have earlier or later been worked for gold. At the present time 18 mines are in operation.

Warren county on the northeast, Moore county on the southeast, and the Tennessee line on the west, mark approximately the eastern and western boundaries of the North Carolina gold field as a whole. It passes into Virginia on the north, and into South Carolina and Georgia on the south.

This general field may be divided geologically and geographically into the following six groups or belts, the general location of which is indicated on the accompanying small map (Plate I):

1. The Eastern Carolina Belt.
2. The Carolina Slate Belt.
3. The Carolina Igneous Belt.
4. The Kings Mountain Belt.
5. The South Mountain Belt.
6. The mines west of the Blue Ridge.

These various belts are not in all instances clearly outlined or well marked, and might on extended study be subject to still further differentiation or other revision.

However, they serve the purpose here of simplifying and facilitating the descriptions of the geological features and the distribution of the mines.

Each belt will be taken up and treated separately in the following portions of this report.

HISTORICAL NOTES.

At what time gold mining was first undertaken in North Carolina cannot be ascertained, but several traditions, which carry a large probability of truth, would seem to indicate that the auriferous character of the section was known before the Revolutionary war. One of the localities in this State, which it is believed was worked before that struggle began, was the Oliver mine in Gaston county. The Brewer mine in Chesterfield county, South Carolina, is another; and the "Aborigines" shaft, at this latter place, is still pointed out where work was done earlier than any known records. Information has recently been received of the successful operation of the Parker mine in Cherokee county, N. C., by the Cherokee Indians long before the coming of the white pioneers into that section. They obtained only nugget gold and their art was entirely inadequate to the winning of the fine dust gold.

The first authentic find was on the Reed plantation, in Cabarrus county, where a 17 pound nugget was found in 1799. Its value was not suspected at first, but when it was ascertained to be gold, a systematic search was undertaken, and a large number of nuggets were unearthed.[1]

Success at this mine stimulated search elsewhere; nugget gold was found at the Dunn mine in Mecklenburg county soon afterwards, and curious stories are still current of the common uses to which these nuggets were put by the local gunsmiths.

By 1825 gold mining on a vigorous scale was carried on along the entire Appalachian slope, from Virginia to Alabama. The placers or like deposits were first worked, then the gossan outcrops of the veins, where slight skill with few and cheap appliances were adequate to the work. The exhaustion of these easily worked stores was effected about the time of the discovery of gold in Cal-

[1] Emmons' Geology of the Midland counties of North Carolina, 1856, page 166.

ifornia and there was a large exodus of miners to that territory. The mining work had not recovered from the retarding influences of this exodus when the civil war came and put an end to all work. At the close of the war but one gold mine in North Carolina was in operation. Since then there have been spasmodic revivals and depressions in gold mining throughout the State, and at the present time everything points to a healthy growth of the industry.

GOLD AND SILVER PRODUCED IN NORTH CAROLINA.

The total amount of the precious metals produced by the mines of North Carolina up to Nov. 30th, 1894, so far as the United States records offer evidence is as follows:

Gold (coining rate)	$11,754,369.60
Silver " "	63,620.40
Total,	$11,817,990.00

It is certain, however, that this is but a part of the production, for much of it is known to have been exported directly by companies having headquarters abroad. Moreover, up to the time of the discovery of gold in California, there was a large demand for native gold by jewelers, and the Carolina gold was in request on account of its beauty. It is not an unreasonable conjecture that the amount which has in various ways escaped official notice is as large as that on record; and that the total amount produced in the State can hardly have been less than $24,000,000.00.

It should be added that the statistics for silver are trebly obscure, for in addition to the vicissitudes observed in the disposition of the gold mined in North Carolina, this metal has passed in a much greater proportion than gold directly into the channels of commerce, through private refineries and smelting works, inasmuch as since 1873 the United States Mint has not purchased silver from depositors. The fluctuating and low price of silver since 1873 as compared with the coining rate is also confusing. The silver produced in the State, at its coining rate, would probably be swollen in even greater proportion than that of the gold.

The following statistics since 1880 are given, from the records of the United States Mint:

TABLE I. *Gold and Silver produced in North Carolina, deposited at the United States Mint and Assay offices.*

YEAR.	GOLD.	SILVER.	YEAR.	GOLD.	SILVER.
1880	$ 77,405.30	$ 365.33	1888	$ 88,641.47	$ 2,787.80
1881	55,989.97	510.12	1889	81,196.33	7,803.12
1882	82,472,84	662.96	1890	75,192.13	1,644.77
1883	100,223.84	797.57	1891	53,992.75	512.96
1884	88,861.11	568.09	1892	50,335.67	475.96
1885	64,826.25	591.07	1893	36,454.49	348.44
1886	83,400.20	784.71	1894	46,592.45	454.83
1887	216,788.08	2,756.37			

TABLE II. *Estimate of the production of Gold and Silver (combined) in North Carolina.*

1880	$ 95,000	1885	$ 155,000	1890	$ 126,397
1881	115,000	1886	178,000	1891	101,477
1882	215,000	1887	230,000	1892	90,196
1883	170,000	1888	139,500	1893	70,505
1884	160,500	1889	150,174	1894	52,927

CHARACTER AND FINENESS OF GOLD AND SILVER.

With the exception of minute quantities of telluride of gold at the Kings Mountain mine, and possibly a few others, the gold in this State is believed to exist in the metallic state, and is invariably alloyed with silver, in proportions varying from 50 to 600 one-thousandths of silver.

Native silver was found in some quantity at the Silver Hill mine in Davidson county, at the McMackin and Troutman mines near Gold Hill, and at the Copper Knob mine in Ashe county. Sulphide of silver is also reported to have been seen at the latter mine. Chlorides and bromides, with their associated minerals, are found only in extremely small quantities, and are of no importance commercially.

Outside of these associations, silver is found in the galenas and zinc-blendes, with commonly only a small content in gold. Zinc ores, dissociated from galena, are very rare, while lead ores free from large amounts of zinc are also infrequent. In a word, the lead

ores of North Carolina are usually zinciferous; they are commonly argentiferous, and to a slight extent auriferous.

The fineness of native gold varies throughout the State, and to a large extent with the different formations in which it occurs. The Eastern Carolina belt shows a variable fineness at the different points. Thus, toward the northern part of the State, well up to the Virginia line, assays show the gold to be about 925 m. fine, with from 60 to 75 m. silver and a *very* little iron, and occasionally a trace of copper; at the Portis mine in Warren county, for example, very rarely does the fineness reach to 950 m. Further south, in Moore county, the range in fineness is from 700 to 750 (rarely 850) gold, and 225 to 300 silver, with similar base constituents. In the first mentioned locality, the gold is almost entirely "placer"; in the latter it is partly derived from a mill treatment of the schists.

Throughout this entire area, arsenic, antimony, etc., are rare in the native gold, and it is not quite certain that these metals may not have been introduced by careless manipulation.

In the Carolina Igneous region, gold ranges from 800 to 950 (*very* rarely 975). Thus, for example, at the North State, Phœnix, Reed, Capps and Rudisil mines, 900 to 925 would characterize the average, with a trifle more iron, and sometimes with as much as 5 to 10 of copper—for the gold comes from veins, which carry large bodies of chalcopyrite.

In the Carolina Slate region, just to the east of this Carolina Igneous belt, the gold is derived from schists, which often carry pyrites or galenites, and these, especially the galenites, have apparently had a large influence in lowering the grade, which rarely rises to 900; examples of this may be seen at the Howie, where the fineness of the gold varies from 725 to 775; at Gold Hill, from 850 to 900; at the Phifer, from 750 to 800; and most frequently the fineness will not rise above 825. Where galenite is abundant, the proportion of gold is reduced to 450, and on rare occasions to a still lower point, as, for example, at the Davis mine, we find gold as low as 450, and sometimes less; at the Stewart, gold 550, silver 447. The native gold itself does not often contain more than a trace of lead.

In the extreme western part of the State, the gold is almost wholly placer gold, and occurs more or less in nuggets. The fineness is rarely as low as 800, and most generally runs above 900—occasionally rising to 980—with the least possible amount of base metal.

In the Burke county mines (South Mountain belt) which are chiefly placer, the gold is tolerably uniform, from 825 to 850, as may be observed at the J. C. Mills mines, the Hancock mine, and the Brindletown localities generally. In the adjacent county, McDowell, the grade lessens to 780 or 800; as at the Vein Mountain mine. In Rutherford county it rises to nearly 900. In Polk county the fineness again rises, being rarely less than 900, and often more than 950; as may be observed at the Double Branch, and the Splawn mines.

When it is said that iron is found in native gold, the statement must not pass without some qualification, for in some cases it is known to be due to a slight proportion of oxide of iron, mechanically contained in the minute cells of the nuggets or grains. And the same has also been occasionally observed of oxide of copper.[1]

THE GOLD-BEARING ROCKS.

The auriferous deposits of North Carolina are contained in the crystalline rocks, which cover more than one-half the area of the State. These rocks include gneisses, metamorphosed schists and slates, siliceous limestone, granite, diorite, diabase and other plutonic eruptives, devitrified ancient volcanics, and pyroclastic breccias. In part (limestones and some of the slates), they show evidence of sedimentary origin, but they are all metamorphosed to such a degree that they are included here under the general term crystalline rocks.

The age of these rocks is not definitely known, but they appear to be Archean, Algonkian, and probably in part Paleozoic.

In the southeastern portion of the gold field, in Union, Stanly and Montgomery counties, is an area of little indurated, bedded slates, of undoubted sedimentary character, which have been

[1] See further the *Engineering and Mining Journal*, September 18, 1886. G. B. Hanna.

called the "Monroe" slates. These are intersected by small auriferous quartz fissures, but their economic value is of little importance.

The Jura Trias (Newark) conglomerates, bordering on the eastern edge of the gold-bearing crystalline rocks, have in several instances (Chatham county) been shown to be very slightly auriferous, but this fact is purely of scientific and not of commercial interest.

STRUCTURE OF THE ORE DEPOSITS.

Structually, the ore deposits are of two principal types: (1) quartz fissure veins containing free gold, and gold in combination with sulphurets. (2) impregnations of free gold and finely divided auriferous sulphurets in the country schists and slates, sometimes accompanied by small lenticular quartz intercalations.

The quartz fissure veins in turn may be differentiated into (*a*) clean cut fissures, intersecting the massive rocks, such as granites, diorites, etc., or cutting the schistosity of the gneisses and schists, both in dip and strike, at a well defined angle; (*b*) a system of larger and smaller lenticular veins of more or less definite extent, approximately conformable to the schistosity of the rocks, but also intersecting the same, usually at small angles, and sometimes cutting across from one lamination to another, or sending off irregular and discontinuous stringers into the wall rock; (*c*) a system of reticulated veins.

The second class, the auriferous schists, are sometimes hundreds of feet in width, though not by any means necessarily capable of being worked profitably in their whole extent. Almost invariably the larger the ore body, the lower the grade of the ore; and these large bodies of auriferous schist form the low grade ores of North Carolina, as they do throughout the entire southern Appalachian, as well as other gold fields.

The gold is not uniformly distributed in the ore bodies; both the veins and schists have "chimneys" or "shoots" in which the gold is concentrated, leaving the intermediate parts relatively poor, though all parts commonly have some valuable contents. These "shoots" have a pitch of their own in the vein or ore body.

The line of separation is not clearly defined, except to the experienced miner, who can discriminate the limits of the secondary action, which has charged the "shoots".

Moreover, the country rock in the vicinity of the ore bodies almost everywhere carries some sulphurets (usually pyrite), which contain at least a trace of gold.

INFLUENCE OF WEATHERING AGENCIES ON THE ORE BODIES.

The entire surface of the country has long been subject to weathering agencies; and as a result the rocks, together with the auriferous bodies contained in them, have been decomposed to considerable depths, occasionally reaching 200 feet. Nearly or quite to the depths of these alterations, and almost always to the permanent water line, which is rarely more than 50 feet from the surface, the gold is in a free condition.

In these upper, decomposed portions (the gossan) of the ore bodies the pyrite is for the most part changed to brown hematite (brown ore), the copper sulphides have become malachite (rarely azurite), chrysocalla, and occasionally either black or red oxide of copper, or else the copper constituents have been almost entirely leached out, and similarly the lead and zinc sulphides have been altered. The decomposed "brown ore" holds not only the gold, which was originally in the sulphurets, but it has been further enriched as a result of the alterations which have taken place, as is evidenced by the presence of nuggets and grain gold, which is always found in this zone more abundantly than in the deeper ores. Ores of this class are not difficult to work, and require little and inexpensive machinery. The treatment is rather a mechanical process than a metallurgical one, and with close attention to the process a large part of the precious contents is extracted at a small cost. The larger bodies of brown ores have by this time been practically exhausted, and the work henceforth must generally be on the deeper, more complex, and as a rule, less rich ores.

Below the water level the ores are only partly altered at most. However, native gold is often found attached to the sulphurets,

and a simple concentration of the ores will generally disclose free gold. But the yield by stamp-mill amalgamation alone is seldom sufficient to be remunerative, and the ores must be submitted to further mechanical and metallurgical treatment for the extraction of the gold from the sulphurets.

The cost of mining is also largely increased, chiefly as it becomes necessary to use pumping and other machinery, the purchase and maintainance of which are heavy expenses.

The narrow seams and veinlets of quartz, which are extraordinarily abundant in the North Carolina gold field, and which traverse the country in many directions, are oftentimes comparatively rich in gold. The weathering agencies have in time liberated the gold from these veinlets, and from the decomposed masses of country rock, and subsequently concentrated it on the bed of undisturbed rock, or in the streams, thus forming the placer deposits.

CHAPTER II.

THE EASTERN CAROLINA BELT.

GENERAL DESCRIPTION.

This embraces the extreme northeast deposits of the State, in the counties of Warren, Halifax, Franklin and Nash, (see plate I, page 15). The present known area over which the mines are distributed is not less than 300 square miles, extending from the Thomas mine, 1½ miles northeast of Ransom's Bridge, in a southwesterly direction to the Tar river; and it is possible that these boundaries will ultimately be enlarged both to the north and south, and even to the east into the region now covered by recent sands and clays.

On the west this area is bounded by the Louisburg granite.

The country rocks are diorite, chloritic schist, and gneiss. The great abundance of quartz veinlets, from a line to 1½ inches in thickness, is very conspicuous in this district. They commonly run with the lamination, but sometimes cross both the strike and dip of the schistosity; occasionally they occur in considerable numbers close together and constitute a true ore channel. They consist generally of sugary or granular quartz, often seamed and filled with oxide of iron, and are always soft and easily crushed. The smaller seams are usually the richer. The gold appears originally to have been in these narrow seams of quartz, which have been broken down in the process of weathering, and the fragments of which are widely distributed through the soil, and are generally most abundant on the bed rock, 15 to 25 feet below the surface, or in favored sinks and channels.

The richer parts of this district have been worked 60 or 70 years, but those parts which are most accessible to water have been so far exhausted as to be no longer profitable under the simple methods so long practiced; hence the almost total cessation of the heretofore small hydraulic operations, although hydraulic work on a large systematic scale may in many cases be quite feasible.

A large amount of quartz has been accumulated by such work; most of this is auriferous, and capable of being milled at a small profit, as indicated by the following assays:

Assays of free-milling quartz, Eastern Carolina Belt.

	(1)	(2)	(3)
Gold (per ton)	$2.07	$3.10	$2.59
Silver (per ton)	trace.	trace.	trace.

Most of the mines of this district have the same salient characteristics and demand the same mode of treatment; though some, like the Portis, are situated on elevated land, and are not naturally well supplied with water.

A combined hydraulic and milling method, such as is used so extensively in Dahlonega, Georgia, may in many cases be adaptable to the mines of the Eastern Carolina belt.

The production of this district has unquestionably been very considerable, but whether the three or four millions of dollars attributed to it can be substantiated may admit of some doubt.

GOLD DEPOSITS AND MINES IN THE EASTERN CAROLINA BELT.

Among the more noted mines of the region, which have been worked, are the following:

The Portis Mine[1] is situated near Ransom's Bridge in the northeastern corner of Franklin county, about 18 miles E. N. E. from Louisburg, on a hill 108 feet above Shocco creek, from which water for hydraulic work is obtained.

The only work of any consequence that has been done here was surface sluicing and some hydraulicking, to a depth of from 15 to 30 feet. Recently some prospect pits have been sunk on various portions of the property, but none of these extend to the water level, being entirely in the upper decomposed rock layer. Practically very little can be learned, either in regard to the true nature of the deposits in place, or the nature and relations of the country rock.

The country rock appears to be diorite, which in general is greatly decomposed and beyond recognition; only at a few points were fairly fresh specimens found.

[1]Geolog. Report of the Midland Counties of N. C., p. 140.

From a statement of Col. Sturgess, the owner, it appears that there are two main zones of ore, nearly at right angles to each other. One of these strikes about N. 50° E., and dips 25° S. E., as determined in a shallow prospect shaft. The ore body consists of a mass of small and large reticulated quartz veins (up to 2 feet thick) in the diorite, measuring about 9 feet in total width. The quartz is stained brown, and is for the most part of a saccharoidal character.

The other zone is known locally as the "White Belt", and, like the first, consists of a network of reticulated quartz veins. The thickness of the deposit is stated to be about 9 feet. It is called the "White Belt" presumably on account of the appearance of the decomposed diorite, which is a soft bleached mass. The strike is west of north, and the dip westward at a very low angle. A former miner stated, that in a distance of 300 yards to the west of the outcrop, the depth of the ore body was only 40 feet.

Some loose pieces of diabase were found near one of these openings, but not in place. It is stated that this rock occurs in boulders just above the ore of the "White Bank"; and it is possible therefore that the diabase exists as an intrusive dike lying with the ore body, nearly flat and above it, or it may exist in more vertical dikes somewhere. Its true relation could not be determined. At least one might say that it appears to be associated with the ore body.

It is stated that the upper decomposed rock layer is everywhere auriferous, and will pay to hydraulic. The scarcity of water is the great impediment. Small irregular quartz stringers occur promiscuously throughout the country rock.

At one point a line has been hydraulicked, and Col. Sturgess reports that 1000 cubic yards yielded 1018 pennyweights of gold, the loose vein rock obtained in this mass averaging about $8 per ton, assay value.

The Mann-Arrington Mine is situated in the northwest corner of Nash county, at Argo P. O., five miles southeast of Ransom's Bridge. The country rock is chloritic schist, in part porphyritic, some of the phenocrysts being ⅛ inch in diameter. It may be a

metamorphosed diorite. The strike is N. 58° E., dip 40° S. E. The rock contains iron sulphurets, and quartz lenses, from minute size up to 12 inches in thickness. These lenses are interlaminated in the schist, and some were observed to cut the schistosity at low angles. The quartz is generally quite saccharoidal, and often of a reddish brown color from the decomposed sulphurets, having a "live" appearance for gold. It contains included fragments of chlorite. The mine has been worked to a depth of about 108 feet, but is now idle.

The Arrington Mine is in Nash county, one mile southeast of the Portis. The mine tract comprises nearly 2,000 acres of land extending two or three miles down Fishing Creek. After the Portis, this mine is the best known of the region.

The Thomas, Kearney, Taylor, Mann and Davis (in Halifax county), are other but less prominent mines of this region.

The Nick Arrington Mine is twelve miles east of the Portis.

The Conyers Mine is seven miles from Whitakers, on Fishing creek. There is an 18-inch vein of brown and sulphurretted ore, in addition to a large quantity of "pay" gravel. The shaft is 30 feet deep, and is reported to show milling ore all the way.

Near Springhope on Tar river, about 20 miles west of Rocky Mount, considerable surface washing has been done, and a large amount of gold extracted, but there has been no systematic work.

On the Woodward-Hedgepath tract, 2 miles from Nashville, a strong vein 3 feet wide has lately been opened up for a distance of more than one mile. The ore is cellular quartz, containing iron pyrites; adjacent is a parallel body of auriferous slates.

CHAPTER III.

THE CAROLINA SLATE BELT.

CHARACTER AND AGE OF THE ROCKS.

The term slate, as used in this connection, covers a broad designation. The country rocks of this important belt are:

1. Argillaceous, sericitic (hydromicaceous), and chloritic metamorphosed slates and crystalline schists.
2. Sedimentary pre-Jura-Trias slates.
3. Ancient volcanic rhyolites, quartz-porphyries, etc. (flint, hornstone, etc.), and pyroclastic breccias, often sheared.

This area of metamorphic slates and schists embraces a belt extending in a general southwesterly direction across the central part of the State, and varying in width from 8 to 50 miles. It is bounded on the west by the central igneous area (Emmons' pyro-crystalline rocks, Kerr's Lower Laurentian), and on the east for the greater part by the Jura-Trias; also in the northern part by a small area of Archean rocks (Kerr's Upper Laurentian); and in the southeastern part by a small embayment of the Coastal Plain. This is the so-called "great slate belt" of Olmsted, the "Taconic" of Emmons and the "Huronian" of Kerr.

In order to gain a more comprehensive oversight of this important geological area, it will be well to state in a few words both Emmons' conception of his Taconic, and Kerr's conception of his Huronian in this part of North Carolina, without comment; and then to discuss the same in the light of more recent investigation. This is by no means intended to be a general discussion of the Taconic question, but simply in so far as it refers to this particular zone of gold-bearing rocks. The investigations carried on in this field during the autumn of 1894 were of necessity very cursory and incomplete, and can only form the beginning of a more thorough study of the region later on.

EMMONS' TACONIC SYSTEM IN NORTH CAROLINA.[1]

Emmons places these rocks among the lowest members of the oldest sedimentaries, i. e., at the base of the Paleozoic.

[1] Geological Report of the Midland Counties of N. C., 1856; pp. 38-73.

"The formations of the midland counties, which occupy the largest extent of surface, are slates and siliceous rocks, which have been called quartzites." * * * * "The slates are variable in color and composition. They are mineralogically clay, chloritic and talcose slates, taking silica into their composition at times, and even passing into fine grits and hornestones, but still variable in coarseness. In the order in which they lie, the talcose slates and quartzites are the inferior rocks, though quartzites occur also in the condition of chert, flint or hornestones in all the series."

He establishes their sedimentary origin from the occurence of numerous beds containing rounded pebbles. Further, "many beds which look like sediments, are porphyrized and somewhat changed, though not strictly porphyries; and these porphyrized beds also frequently contain pebbles, and are therefore partially altered sediments".

One of the arguments that Emmons uses to prove the sedimentary nature of the Taconic and its derivation from the basal complex, is the presence of gold in the slates and schists, "which of course must have been commingled with the sediments at the time these rocks were deposited". * * * * * * * "The gold exists mostly in the western belt of granite in the veins belonging to the hornblende and gneiss of the Blue Ridge."

Furthermore he claims to have discovered in his Lower Taconic sandstones and cherty beds at Troy and Zion (12 miles S. W. of Troy) in Montgomery county, 2 or 3 species of fossils.[1]

These fossils he describes as siliceous corals of a lenticular form, from the size of a pea to 2 inches in diameter. Two varieties are distinguished and named by him Paleotrochis (old messenger) major and Paleotrochis minor. He also reports to have found one or two specimens of an obscure bryozoon.

The following descriptive section in the ascending order of the rocks and beds, in which these fossils were found, is given:[2]

1. Talcose slates, passing into siliceous slates, and which are often obscurely brecciated.
2. Brecciated conglomerates, sometimes porphyrized.

[1] Geol. Rept. of the Midland counties of N. C., 1856, p. 60.
[2] Ibid, p. 61.

3. Slaty breccia, associated with hornstone.
4. Granular quartz, sometimes vitreous and filled with fossils and siliceous concretions of the size of almonds.
5. Slaty quartzite with very few fossils.
6. Slate without fossils.
7. White quartz, more or less vitrified, filled with fossils and concretions.
8. Jointed granular quartz, with only a few fossils.
9. Vitrified quartz without fossils.
10. Granular quartz, no fossils.

"The fossils also occur in the variety of quartz or quartzite known as burrhstone, and which is often porphyrized. The fossiliferous beds themselves are sometimes auriferous."

He is therefore disposed from these facts to place all the rocks, not decidedly igneous, or which he regarded as stratified (though in reality the apparent statification is but schistose lamination), with the sediments. He then correlates these rocks with the Taconic, the infrasilurian sediments of Massachusetts, mainly from their lithological characters, and the relations in which they are placed to the older rocks, and those which they sustain to each other. In North Carolina, he says, these rocks have been derived from syenitic granites, which he believes to belong to the primary or basal complex. He makes two divisions, the Lower Taconic and the Upper Taconic, the distinction between them, however, being less obvious in North Carolina, than in the northern equivalents.

THE LOWER TACONIC.

"*The Lower* series (Taconic) will contain the talcose slates, white and brown sandstone, or quartz, which is frequently vitrified or cherty, and the granular limestone and associated slates."[1]

The talc slate is made up of talc and fine grains of quartz. Color and lustre is silvery when chlorite is absent, and greenish when chlorite is present. When quartz predominates it becomes a friable sandstone.

The quartz rocks, white and brown sandstones, occur under the following varieties:

1. A fine grained coherent quartz.
2. A fine grained friable quartz.

[1]Geol. Rept. Midland Counties of N. C., 1856, p. 49.

3. A fine grained micaceous and talcose quartz.
4. Vitrified quartz or chert.
   (a) green, blue. (b) agatized.
5. A cherty or apparently porphyrized quartz, which contains feldspar, which decomposes and leaves a rough porous mass similar to burrhstone.
6. Pebbly and semi-brecciated quartz.
7. Common brown quartz.

This rock is associated with the talcose slates, and is repeated two or three times; it frequently contains pebbles, and passes into hornstone, chert or flint.

The apparent vitrification he considers due to a chemical combination of the particles, or to a cause independent and distinct from heat.

"Agalmatolite" (pyrophyllite) also occurs in beds in this Lower Taconic series.

The limestone is associated with slate and quartz, and contains talc and tremolite.

The rocks of the Lower Taconic then are:

1. Beds of talcose slates. 2. Quartz rocks with their alternating series of talcose slates. 3. Beds of agalmatolite. 4. Limestone with its interlaminated slates.

THE UPPER TACONIC.

"The upper (series) will contain (in ascending order) the green clay slates novaculite, the argillaceous, and sometimes chloritic sandstones or grits, and the brecciated conglomerates."[1]

This division of the system is not very clearly marked, but the rocks regarded by Emmons as belonging to it in North Carolina are:

1. *The argillaceous or clay slates and subordinate beds.* Ordinary soft, greenish slates are the prevailing rocks. A red decomposed variety is mentioned as being common near Pittsboro, Chatham county. The subordinate beds are fine siliceous slates, passing into chert and hornstone. Color blue, purple and green.

2. *The chloritic and argillaceous sandstones* have an interme-

[1] Emmons: Geol. Report Midland Counties of N. C., 1856, p. 49.

diate composition between sandstone and slate. They are finer and more chloritic and among them are beds of conglomerate. These chloritic beds may be taken for trap, being greenish and tough, and besides like trap the broken strata exfoliate in concentric layers.

3. *The brecciated conglomerate* has an argillaceous or chloritic base. The mass is composed in the main of fragments of other rocks, mostly retaining an angular form. These fragments are sometimes as much as 2 feet long.

The clay slates and breccias, with their intermediate beds, are traversed by veins of milky quartz; these are sometimes auriferous, but usually barren.

The socalled quartzite of both the Upper and Lower Taconic is considered of such peculiarity that a separate chapter is devoted to its description. It is an uncrystallized (crypto-crystalline) quartz resembling gun-flint, also called flint, chert and hornstone. Color bluish-black, passing to purple, grayish, white and green; sometimes banded; texture fine when compared with the finest sandstone; translucent on the edges; fracture flat conchoidal; often porphyritic or porphyrized, and frequently the fresh fracture is dotted with small limpid crystals of quartz.

These quartzites are not confined to rocks of a particular age or given series. They seem to be distributed through formations of all ages and epochs. Emmons explains their origin rather from a chemical than from a metamorphic standpoint.[1]

KERR'S HURONIAN SYSTEM IN CENTRAL NORTH CAROLINA.[2]

Kerr recognizes five principal outcrops of the Huronian rocks. The one that corresponds to the central auriferous slate belt, and hence of interest here, lies on the west side of the Raleigh granite. "The bottom beds are argillaceous and talcoid; * * * * * * * three to four miles from Raleigh these slates become highly plumbaginous, * * and a heavy body of micaceous, white, slaty quartzites follows closely along the west side of the graphite. Alternations of argillaceous, talcoid and

[1]Geol. Rept. Midland Counties of N. C., p. 51.
[2]Report of the Geological Survey of North Carolina. 1875. vol. 1; pp. 131-139.

quartzitic beds continue for five or six miles, when they disappear beneath a narrow trough of Triassic sandstones, beyond which they emerge along an irregular, but approximately N. E. and S. W. line in the general central mineral bearing slate belt. * * * * * * * * It is composed of siliceous slates and clay slates chiefly; the former being often brecciated and conglomerate, the pebbles sometimes a foot and upwards in diameter, frequently chloritic, and often passing into hornstone and chert and occasionally into quartzite. The clay slates are generally thin bedded, often shaly, grey, drab, banded, blue and frequently greenish from an admixture of chlorite; sometimes talcoid or hydro-micaceous; and very often they may be better described as conglomerate slates, being composed of flattened and differently colored soft, slaty fragments of all sizes, from minute particles to an inch and more in diameter. * * * * * * * * * in Montgomery county, in a very heavy ledge of siliceous slates, occurs a siliceous conglomerate which is filled for hundreds of feet with very singular siliceous concretions, some of which Dr. Emmons has described under the name of Paleotrochis; but the rock for several miles, as well as at this particular locality, contains a multitude of rounded and ovoid masses from the smallest sizes to that of a hen's egg; showing the wide prevalence of conditions favorable to the operation of concretionary forces."

He also mentions the occurrence of beds of pyrophyllite, and the abundance of quartz veins. The strike is northeast and the dip is prevalently west at high angles.

"The belt is bounded on both sides by the Laurentian on which it lies unconformably, and from which its materials were derived. The stratigraphy therefore indicates the horizon of these rocks to be the Huronian, and lithology agrees well with that determination."

RESULTS OF MORE RECENT PETROGRAPHIC STUDIES.

THE SLATES AND SCHISTS.

One of the results of the present survey in this belt has been to identify at least the argillaceous, sericitic and chloritic schists

and slates with those of Emmons' Taconic and Kerr's Huronian. (The Monroe slates form an exception and will be spoken of later—p. 36). These rocks have in places been called schists, in others slates. Certainly a great number of the rocks have a true slaty cleavage, while others are more truly schistose, i. e. the laminae are not essentially parallel. These structural effects are due to the action of dynamic metamorphism on materials of different composition. The argillaceous types might more properly be called the slates (clay-slate, thon-schiefer, argyllite, phyllite) as they contain more uncrystalline matter, and possess a more definitely slaty structure. So also bedding planes are more easily distinguishable in these, if at all; and altogether their sedimentary or clastic origin is more evident. At the same time they are metamorphosed in varying degrees and possess many secondary cleavage structures. These slates often have a calcareous tendency in their composition, as exemplified by the numerous small calcite seams that intersect them and the coatings of calcite on their cleavage planes.

The term *talc* (*talcose*, *talcoid*) slate or schist, used by Emmons and Kerr, and generally by many other writers, is a mistaken one. It is true that it is perhaps an excusable mistake, for these slates and schists are often so soft and greasy that the resemblance to talc is very great. However, chemical analysis and other characteristics would place it in the class of hydro-muscovite or sericite, the percentage of magnesia being far too small for talc. Several analyses of type specimens of this rock from the Haile mine in Lancaster county, S. C., by Dr. Chas. Baskerville, show:

Analyses of Sericite Schist, Haile Mine, S. C.

	(4)	(5)
SiO_2	44.61%	61.02%
Al_2O_3	31.57	25.54
FeO	3.55	4.46
CaO	0.20	0.60
MgO	0.22	0.14
MnO	0.16	—
Na_2O	6.96	2.19
K_2O	6.97	1.81
H_2O	5.80	4.20
	100.04	99.96

The term that we shall therefore use as more appropriate is sericite schist. The true talc schists are very rare.

The chloritic schists are probably more truly crystalline schists, and are richer in accessory metamorphic minerals, such as garnet and epidote.

The argillaceous slates and sericite schists are often silicified; the clorite schists are not as a rule. This silicification exists in varying degrees up to a completeness which renders the rock so hard that it resists scratching with a knife. This subject will be referred to again in the discussion of the genesis of the gold ores (see p. 47).

The strike of the formation as a whole is generally N. E. and S. W., and the dip steeply to the N. W. These strikes and dips refer to the schistosity of the rocks, and not to bedding planes. In the separate descriptions of the mines, wherever the bedding of the slates could be determined, and the instances were rare, it is so stated.

In general the force producing schistosity and slaty cleavage appears to have acted downward from the northwest, producing normal faulting with but little deformation. No instance of reverse faulting was recorded.

Now, as to the origin of these schistose and slaty rocks; in part, it seems that they must be sedimentaries altered by dynamo- and hydro-metamorphism. The evidence of this is offered by several observations of bedding and banding extending across the schistosity, generally at a low angle, as for instance at the Bonnie Bell, Stewart, and Russell mines.

Their lamination or schistosity, however, is wholly the effect of shearing, produced by dynamo-metamorphism, and not bedding planes of stratigraphic structure, as both Emmons and Kerr supposed. The original bedding planes may correspond to certain of the present cleavage planes, i. e., lie parallel to them, but in that case the bedding structure has been obliterated. Schistosity must not be confounded with bedding.

It does not seem probable at the present stage of the investigation, that these slates have been derived from the granitic and

other more basic igneous masses lying on the west; for as noted further on, these are supposed to be later intrusive bosses.

That others of these schists, particularly the chloritic varieties, are metamorphosed, sheared eruptives seems equally probable; such for instance are the schists of the Jones, Parker, Mann Arrington, etc., mines. They are even porphyritic and brecciated in places. In fact Emmons hints at such rocks in his description of the Upper Taconic chloritic member, when he says "These beds may be mistaken for trap, being greenish and tough, and besides like trap, the broken strata exfoliate in concentric layers"[1] (p. 32). This subject will be recurred to later on.

THE MONROE SLATES.

At Monroe in Union County, a considerable area of truly bedded and but little indurated or metamorphosed slates was discovered. Very similar slates were later on found at the Parker mine, at the town of Albemarle, in Stanly county, and at the Sam Christian mine, in Montgomery county. Thus presumably they cover a large area in the southeastern portion of the "Carolina Slate Belt." In the fresh condition this slate is black, weathering to dark and light drab, greenish and even reddish in color. At the railroad station (Monroe) it lies in a low, gently undulating anticlinorium. Several hundred yards south of the depot the strike is N. 85° E., and the dip 30° S. E. At this point it is intersected by numerous small quartz fissures, from the thickness of a knife edge to 2 inches, striking north and south, and standing nearly vertical. At a point ¼ mile north of the depot it is finely banded and lies nearly horizontal. It has been quarried here for use as paving blocks in Monroe.

These slates were not recognized by either Emmons or Kerr. That they are of sedimentary origin and of later age than the slates and schists to the west and north can scarcely admit of doubt. They are reported to dip under the Jura Trias conglomerate at Polkton, about 20 miles east of Monroe, and might be looked upon as Lower Paleozoic; but the absence of fossils (at

[1]Geol. Rept. Midland Counties of N. C., 1856, p. 66.

least so far none have been found, though a careful search is certainly warranted) must, for the time being, place them provisionally in the Algonkian. They might appropriately be named the "Monroe" slates.

QUARTZ ROCKS—THE VOLCANIC SERIES.

The middle member of Emmons' Lower Taconic is the quartz rock (white and brown sandstone), which exists in many varieties.[1] The work of the present Survey did not discover any true granular quartzites, such as characterize the Cambrian (even in a metamorphosed state); and in fact, from Emmons' and Kerr's descriptions, their rocks of this class are rather fine-grained, thin-bedded, quartzose schists, and devitrified quartz or chert, often porphyrized and brecciated. It is probable that Emmons' fine-grained, talcose quartz corresponds to the silicified argyllites and schists (p. 31), whose origin is due to a later hydro-silicification.[2]

The crypto-crystalline varieties of quartz (flint, chert, hornstone, agatized, chalcedonic) are of especial interest, and warrant a careful consideration. It is again deplored in this connection that the present report did not allow the time for a microscopic study of the thin sections. Such cherty, flint-like masses have been described from the Sam Christian, Moratock, Silver Valley and Hoover Hill mines. It is at present the opinion that these rocks belong to the class of ancient (pre-Cambrian) acid volcanics, in many respects analagous to, and probably contemporaneous with, similar rocks of South Mountain in Maryland and Pennsylvania, whose discovery was first announced by the late Dr. Geo. H. Williams.[3] Miss Florence Bascom has described the origin, devitrification and structure of the acid types of these rocks.[4] Dr. Williams has outlined the general distribution of the ancient volcanic rocks along the eastern border of North America.[5] These rocks are analogous also to the hälleflintas and eurites of Southern Sweden, described as volcanic rocks by Nordenskjöld.

[1] Geol. Rept., Midland counties of N. C., 1856, p. 50,
[2] Ibid, p. 51.
[3] The Volcanic Rocks of the South Mts. in Pa. and Md. Am. Jour. Sci. xliv., Dec. 1892, pp. 482-496. Scientif. Amer., Jan. 14., 1893.
[4] Jour. Geology, Vol. 1, 1893, pp. 813 832.
[5] Ibid, Vol. 2, 1894, pp. 1-31.

They would also correspond to Hunt's pre-Cambrian petro-silex rocks, called by him the Arvonian, being below his Huronian.

The hornstones have every appearance of being acid feldspar quartz rocks, and will probably be found, on further study, to belong to the class of apo-rhyolites, a term introduced by Miss Bascom to denote a devitrified rhyolite. Emmons describes the type very well under the head of quartzite. (p. 32)[1] They resemble perfectly crypto-crystalline quartz, and on weathering present an earthy, yellowish surface. The color of the fresh rock is drab, bluish to almost black ; translucent on edges ; fracture flat conchoidal ; sometimes banded, showing flow structure, as described from the Silver Valley mine where the rock is locally called "gun flint." It often contains small crystals of metallic sulphurets, chiefly pyrite with some galena, chalcopyrite and blende.

From the Moratock mine a siliceous rock is described (p. 79) as a quartz porphyry, which at first sight resembles a compact, homogeneous hornstone, but which on close examination is found to be dotted with small, dark colored, glassy specks ; these are minute quartz crystals. The true porphyritic character of the rock is best illustrated in the weathered specimens, the feldspathic groundmass being decomposed and altered, leaving the quartz phenocrysts clearly outlined. The flow structure is also beautifully brought out in the weathered groundmass.

Emmons, in the description of his quartzite, says they are "often porphyritic or porphyrized, and frequently the fresh fracture is dotted with small limpid crystals of quartz." In the enumeration of the varieties of Lower Taconic quartzites (p. 30) he mentions[1] "a cherty and apparently porphyrized quartz, which contains feldspar, which decomposes and leaves a rough porous mass similar to burrhstone." Kerr says:[2] "In Montgomery county, in a very heavy ledge of siliceous slate, occurs a siliceous conglomerate which is filled for hundreds of feet with very singular, siliceous concretions, some of which Dr. Emmons has described under the name of Paleotrochis ; but the rock for

[1] Geol Report, Midland Counties of N. C., 1856, p. 51.
[2] This Bulletin p. 33; and Geology of North Carolina, 1875, p. 132.

several miles, as well as at this particular locality, contains a multitude of rounded and ovoid masses, from the smallest sizes to that of a hen's egg, showing the wide prevalence of conditions favorable to the operation of concretionary forces." These gentlemen have without much doubt described the quartz porphyry of the Moratock mine.

It appears highly probable that at least some of these siliceous, pebbly concretions are spherulites. Whether they constitute Emmons' pebbly beds, from which he determined the sedimentary origin of his Taconic, is not known. However it is quite possible that they misled him in that direction. Certain it is that he says:[1] "I found, however, many beds among them (slates and associated rocks) which looked like sediments, were porphyrized and somewhat changed, though not strictly porphyries. I found, after much search too, beds which were unequivocally pebbly; and finally, to remove all doubt, I was fortunate in discovering that the porphyrized beds also frequently contained pebbles; proving most conclusively that they are sediments which were partially altered."

Thus he evidently mistook either the concretionary form of the weathered porphyry and felsite, or else the partially rounded felsite fragments in the accompanying pyroclastic breccias (which will be spoken of further on), for pebbles.

Prof. Marsh in 1867 made a short study of Emmons' Paletrochis,[2] and in his words: "An examination of the interior of several specimens clearly indicated that they were not corals, and as soon as microscopical specimens could be prepared, they were more carefully examined, but no trace of organic structure could be detected, the entire mass being evidently a fine grained quartz. The specimens examined were undoubtedly authentic examples of Paleotrochis, as some of them presented to the Yale cabinet by Prof. Dana, were sent to him by Prof. Emmons, and the rest were given to the writer by Prof. W. C. Kerr, the present State Geologist of North Carolina." * * * * * *

[1] Geol. Report, Midland counties of N. C., 1856, p. 47.
[2] Am. Jour. Sci. (2), vol. 45, 1868, p. 217.

"Admitting the inorganic nature of these remarkable forms, their origin becomes an interesting question, and it certainly is not easy to give a satisfactory explanation of it. They appear, however, to have some analogy with "cone in cone," which, as the writer has shown elsewhere,[1] is probably due to the action of pressure on concretionary structure when forming. In some respects the two are quite distinct, but evidence of pressure is clearly to be seen in both."

Kerr evidently agreed with Marsh as to the inorganic nature of the Paleotrochis, and Mr. C. D. Walcott, the director of the U. S. Geological Survey, entertains the same opinion.

According to both Emmons' and Kerr's descriptions, these peculiar forms appear to occur in the acid effusive rocks. In his descriptive section of the rocks which carry the Paleotrochis, Emmons names the following:[2]

Granular quartz, sometimes vitreous and filled with fossils and siliceous concretions of the size of almonds.
Slaty quartzite with very few fossils.
Slate without fossils.
White quartz more or less vitrified, filled with fossils and concretions.
Jointed granular quartz with only a few fossils.

And he says: "These fossils also occur in the variety of quartz or quartzite, which I have described as burrhstone, and which is often porphyrized."

An interesting point is suggested in the above succession of rocks, namely, that there was more than one volcanic outbreak, and during at least one period of inactivity slates were deposited.

These acid volcanics are accompanied by pyroclastic breccias and basic eruptives, which are usually schistose. The same succession is also common to the South Mountain region in Maryland and Pennsylvania. Such rocks are described under the head of the Parker, Sam Christian, Moratock, Hoover Hill, Jones and Parish mines. The basic rocks are usually of a dark green color, and are perhaps pyroxenic in composition; sometimes propyllitic; they cover large areas, and are often massive or only partly schistose; again they are largely sheared into schists. A

[1] Proc. Amer. Assoc. Adv. Sci., vol. 16, 1867, p. 135.
[2] Geol. Report, Midland counties of N. C., 1856, p. 61.

wide outcrop of this rock was followed from the Hoover Hill westward to the Jones, Parish, Silver Hill, and Silver Valley mines, and thence westward to near the Lexington granite belt, a distance of over 20 miles. It is quite probable that most of the *chloritic* schists, in this part of the Carolina slate belt, are of this nature.

The breccias consist of this basic material in which are imbedded angular fragments of the felsite (apo-rhyolite) or porphyry up to one foot in diameter. They are distinctly pyroclastic breccias and hence the basic rock, or porphyrite, as it may be provisionally called, is later than the quartz porphyries and rhyolites. This would agree with the generally accepted law of eruptions, i. e., from the normal to the acid to the basic types.

Emmons, in his description of the Upper Taconic, mentions brecciated conglomerates as the most remarkable mass of this division. As he states, "It has an argillaceous or chloritic base. The mass is composed in the main of fragments of other rocks, mostly retaining an angular form; but frequently, rounded and worn rocks are enclosed in the mass. The fragments are sometimes 18 inches and even 2 feet long." [1]

Kerr mentions "brecciated and conglomerate siliceous slates, the pebbles sometimes a foot and upwards in diameter, frequently chloritic and often passing into hornstone and chert, and occasionally into quartzite." [2]

That these rocks correspond to the above described pyroclastic breccias is at once evident.

These ancient volcanics have also been found covering large areas in Chatham and Orange counties, near the eastern edge of the Carolina slate belt, and fully 40 miles east of the region including the above described localities. During the summer of 1893, Dr. Geo. H. Williams in company with Prof. J. A. Holmes, made a reconnaisance trip through Chatham and Orange counties, the results of which are included in Dr Williams' paper on the distribution of the ancient volcanic rocks in eastern North America.[3] He says: "In a drive from San-

[1] Geol. Report Midland Counties of N. C. 1856, p. 67.
[2] Report of the Geol. Survey of N. C., Vol. I, 1875, p. 132.
[3] Journal of Geology, Vol. 2, 1894, pp. 1-32.

ford to Chapel Hill an abundance of the most typical ancient lavas, mostly of the acid type, was encountered. On the road from Sanford to Pittsboro purple felsites and porphyries showing spherulitic and beautiful flow structures and accompanied by pyroclastic breccias and tuffs, were met with two miles north of Deep river and were almost continuously exposed on Rocky river. Here devitrified acid glasses with chains of spherulitic and eutaxitic structure were collected, while beyond, as far as Bynum on Haw river, 4 miles northeast of Pittsboro, the only rocks seen were of the same general character. On the farm of Spence Taylor, Esq., in Pittsboro, a bright red porphyry with flow lines is exposed in so altered a condition that it can easily be cut into any form with a knife, though it still preserves all the details of its structure. * * * * * * Three-quarters of a mile beyond Pittsboro, on the Bynum road, there is a considerable exposure of a basic amygdaloid. South of Hackney's Cross roads there are other excellent exposures of the ancient rhyolite with finely developed spherulitic and flow structures. * * * * * * Another locality in the volcanic belt was visited on Morgan's run, about 2 miles south of Chapel Hill. Here are to be seen admirable exposures of volcanic flow and breccias with finer tuff deposits, which have been extensively sheared into slates by dynamic agency. Towards the east and north these rocks pass under the transgression of Newark sandstone. * * * * * * From still another locality at the Cross Road near the northern boundary of Chatham county, 15 miles southwest of Chapel Hill, Prof. Holmes informs me that specimens of undoubted volcanic rocks have recently been secured. He has also sent me, within the past month, a suite of similar specimens from Pace's Bridge, on Haw river, 3 miles above Bynum."

Since that time the same volcanics have been found at the Narrows of the Yadkin river, on the Deep river at Lockville, Chatham county, and for 5 or 6 miles northwest of Lockville. At the last two localities the masses are often brecciated and usually sheared into perfect crystalline chloritic schists.

It is of interest to note in the above descriptions of Dr. Williams, the occurrence, on the Taylor farm near Pittsboro, of

a bright red porphyry with flow lines, in so altered a conditon that it can be easily cut into any form with a knife. This is undoubtedly the same rock, and from the same locality, described by Emmons (p 31.) as a decomposed red variety of his Upper Taconic argillaceous or clay slate. [1]

CONCLUSIONS.

In this brief resume then, we can recognize Emmons' Taconic and Kerr's Huronian rocks of the central ore-bearing slate belt.

The bitter controversies regarding the Taconic question among geologists are well known, and need not be taken up here. It is sufficient to say that geologists by later and more detailed work and study have seen fit to differentiate various members of the old Taconic System in different parts of the country, and refer them to more definite horizons. Thus the granular quartz of Emmons' typical Taconic section in the Berkshire Hills of Massachusetts, has been found to be characterized by the Olenellus fauna of the Lower Cambrian; and the Berkshire or Stockbridge limestone by the Chazy-Trenton, and perhaps at its base by an Upper Cambrian fauna; and the original Lower Taconic slate of Emmons is correlated, by its stratigraphic position, with the Hudson shales.[2] In 1888, Walcott, in studying a section of these rocks in Newfoundland, placed, from paleontological evidences, the "Red Sandrock" series, the Georgia shale and slate series, the "Granular Quartz" and the "Upper Taconic" of Emmons beneath the Middle Cambrian or Parodoxides zone of the Atlantic coast.[3]

And so the rocks of the old Taconic or Huronian belt in North Carolina must also in time be differentiated and recorrelated, when they have been more carefully studied.

Along the extreme western edge of the State from Mitchell to Cherokee county, the quartzites, slates, limestones, and conglomerates (here also in a great measure sheared and metamorphosed) which constitute Kerr's western Huronian belt or "Chero-

[1] Geol. Rept. Midland Counties of N. C., 1856; p. 65.
[2] United States Geological Survey. Bulletin 81. Correlation Papers: Cambrian; by C. D. Walcott; 1891, p. 243.
[3] Ibid, p. 113.

kee Slates," have been referred to the "Ocoee"[1] by the recent work of the United States Geological Survey.

Emmons was in a measure quite correct in calling the Taconic rocks of central North Carolina the bottom sediments, and placing them below the Silurian. The absence of fossils in the slates, however, necessitates our going back still another step, and placing them below the Cambrian sediments, in the Algonkian, which VanHise has defined as including all recognizable pre-Cambrian clastics and their equivalent crystallines, the base of the Cambrian being placed at the Olenellus fauna.[2] Here the matter must rest until we can find fossils in the rocks, or verify the organic character of Emmons' Paleotrochis; or until we can trace the rocks into a terrane of known age. So also the pyroclastic volcanics must be looked upon as pre-Cambrian.

It is of interest also to note that here, as in other portions of eastern North America, the ancient volcanics occur in close proximity to the western edge of the Jura-Trias basin. Adopting Suess' theory of the formation of mountains, we may look upon this central belt of sheared and faulted slates as the levelled site of an ancient Atlantic mountain range; while the bordering Jura-Trias represents a transgression formed by the sunken block on the east. Early phases of this subsidence were accompanied by the exhibition of volcanic forces, which found outlets for their material.

THE GENESIS OF THE GOLD ORES.

This involves a consideration of (1) the nature of the deposits, (2) the causes of the formation of the spaces occupied by the ores, (3) the manner of their filling.

1. THE NATURE OF THE DEPOSITS.

From the descriptions of the various mines examined in this belt it is evident that the gold ores exist in two principal structural forms, namely as quartz fissure veins, and as impregnations,

[1] The age of the "Ocoee" is still indefinite, and may be anywhere from the Algonkian to the Carboniferous.
[2] United States Geological Survey. Bulletin 86. Correlation Papers: Archean—Algonkian, p. 495.

lenticular, stringerform and irregular disseminations in the country schists and slates.

The fissure veins in the slates and schists are generally difficult to distinguish as such. Their structure is much more evident in the granitic and other eruptive rocks. In the schists the larger regular quartz lodes lie apparently interlaminated in the country, or have the appearance of lenticular intercalations. However, even here they can usually be shown to intersect the schistosity, generally at a very low angle (as indicated at the Rocky River, Burns, and Mann Arrington mines). Such fissures have, as is usually the case, irregular boundaries, swelling and pinching; and it is also noticeable that they have on a large scale a lenticular structure, at least in linear extent (Rocky River mine). Certain it is that clean cut veinlets of quartz and calcite do occur, distinctly intersecting the cleavage and schistosity (as seen at the Bonnie Bell, Howie, and Moore mines). The Monroe slates also contain true quartz fissure veinlets. (See p. 36.)

The more usual mode of occurence of the ores is as small lenticular and stringerform bodies of auriferous, sulphuretted quartz, and as lenticular and irregular disseminations of sulphurets in the country slates and schists, which are usually silicified, to some extent at least. Such are the Scandinavian "fahlbands", which are described as belts of schists impregnated with sulphides.

Very often the slaty walling of a quartz body is impregnated for some distance with auriferous sulphurets, (as at the Rocky River, Buffalo and other mines). Again in some cases there is apparently no distinct quartz lead whatever, but the slates themselves are pyritic over certain widths and constitute the ore bodies (as at the Russell, Howie, Bonnie Bell, and other mines).

2. THE CAUSES OF THE FORMATION OF THE SPACES OCCUPIED BY THE ORE.

No instances of metasomatic (substitution or replacement) formation of the ores has been observed. They must therefore have found open spaces waiting for their deposition. Furthermore, it is evident that the origin of the ores was not contemporaneous with that of the schists, but later; this will be spoken

of again, (p. 51). The slates and schists are everywhere cleaved and sheared, the usual strike being N. 20° to 55° E., and the dip steeply to the N. W. Observations show that the resultant dynamic force which induced this structure, acted as a rule from the northwest downward, developing normal faulting, with but slight compression. Unfortunately opportunities did not allow of observations which showed direct illustrations of faulting, but it is certainly reasonable to suppose that dislocation must have generally taken place, if but with a very minute throw. And it is accepted that this dislocation, on larger and smaller scales, produced the *spaces of dicission* as Posepny calls them,[1] which were afterwards filled with the ore bearing solutions.

Certain maximum lines of faulting were developed which made room for the larger fissure veins, on either side of which the smaller dislocations formed belts of variable width. Or, where the tension, compression, resistance, etc., were more uniform, larger fissures were absent altogether. The existence of small, isolated impregnations of crystalline sulphurets in the slates may possibly have another explanation. But the lenticular and stringerform quartz bodies, even those of minute size, will scarcely admit of any other. The main course of these belts is N. 20° to 55° E., and the dip is from 55° to 85° N. W. Isolated instances of crossfissuring occur (Ore Hill; the Phifer mine; and the Howie mine, where cross fissures are filled with "reibungs-breccia,") but these are rare occurrences. Indeed it seems reasonable to suppose that in such a sericitic, chloritic, or kaolinitic material as these slates and schists are composed of the chief yielding planes should have been in parallel directions to the cleavage.

The frequent diabase dikes, which exist throughout the region, occupy fissures which strike usually northwest, across the general schistosity of the country, and intersect the ore fissure. These dikes are usually of considerable width, from a few feet to

[1]The Genesis of Ore Deposits, by F. Posepny. Trans. Am. Inst. of Mining Engineers, 1893, vol. 23, pp. 197-370.

as much as 150 feet. They may be looked upon as paraclastic[1] fissures, while the ore fissures are diaclastic.

THE MANNER OF FILLING THE FISSURE OPENINGS.

The theories of the filling of open spaces (spaces of dicission and spaces of dissolution) by their xenogenous[2] mineral contents are so manifold, and they have been the subject of so much controversy among geologists and mining engineers, that care must be exercised in their application. Recently several most admirable treatises have appeared on this subject, chief among them being "The Genesis of Ore Deposits," by F. Posepny (Trans. Amer. Inst. Mining Eng., Vol. 23, 1893, pp. 197-370); and "The Ore Deposits of the United States," by Jas. F. Kemp, (published by the Scientific Publishing Co., N. Y., 1893, second ed., 1894). Work of great excellence and value has also been published in the monographs of the United States Geological Survey, notably by Becker, Emmons, Curtis, Hague, etc.

We can look upon the manner of filling of the spaces of dicission formed by faulting and fracturing, in the area under consideration, in no other way than by the ascension of mineral bearing waters from below. This is the ascension theory upon which Posepny, very properly, lays such great stress, though he is probably inclined to make unduly general application of the same.

And we connect the origin of these deep seated waters with the last stages of the volcanic activity that was general along this line of disturabnce, the so-called solfataric, mofetti and fumarole stages.

Heated carbonated, alkaline waters are capable of taking silica and metallic elements and sulphides into solution. Such waters, perhaps in a very dilute condition, ascended and circulated through the open fissures and spaces, and deposited their mineral contents on the walls, by virtue of relief of pressure, reduction of temperature, and perhaps of certain chemical reactions. The frequent silicification of the

[1] *Paraclastic* dike fissures are such as were opened along entirely new lines, while *diaclastic* ore fissures are such as were opened along cleavage lines which already existed.
[2] Minerals foreign to the rocks contiguous to the vein, i. e. brought up from below.

slates and schists has been noted, and must be ascribed to this permeation by silicified waters. Mr. Becker supposed, very reasonably, that there might be some direct connection between this fact and the richness of the ores, i. e. the highly silicified schists might be also more highly charged with metallic contents. Close inquiry into this, however, has shown us that they are not necessarily richer than the softer varieties, when such are impregnated with xenogenous minerals. And it therefore seems that the main silicification went on independently, it may have been at the same time with the deposition of metallic minerals or subsequently; it was probably more of a chemical than a mechanical action, i. e. certain portions of the original country rock may have been so composed chemically as to have permitted of partial replacement by silicic acid, while others did not.

In two instances only (Burns and Howie mines) was free gold found directly in the soft sericitic schist, which was apparantly entirely unsilicified and free from quartz. However, the absence of quartz or silicification in even an incipient stage cannot be regarded as favorable to the metallic richness of the ore bodies.

The diabase dikes which occur in this region appear in general to have exercised a notably favorble influence on the richness of the ore bodies. The ores are often richer in the vicinity of the dikes. At the Haile mine in Lancaster county, S. C., this is very marked.[1] Presumably the formation of these dike fissures has stimulated and intensified the circulation of the mineral bearing waters below, and it is even probable that these waters may have derived part of their metallic contents from the diabasic magma, which is often slightly pyritic, and has in one case at least been found to contain free gold.[2]

The impregnations of small isolated crystals, up to ¼ inch cube, or fine crystalline aggregates of sulphurets, usually pyrite, in the soft, unsilicified slates, within the limits of the ore belt and at a distance from the same, still remains to be explained.

[1] The Geology of the Haile Mine, S. C., by A. Thies and A. Mezger, Trans. Amer. Inst. Min. Engrs., 1890, Vol. xix. pp. 595-601.

[2] Ores of North Carolina, Raleigh, 1887. Appendix B. "On some Peculiarities in the Occurence of gold in N. C.", by W. C. Kerr, pp. 327-328.; also Trans. Amer. Inst. Min. Engrs., Vol. x., 1882, p. 475.

One explanation would be that the mineral solutions percolated through minute, pre-existing pores in the country rock in which they deposited their contents. The only other way in which to account for their presence would be by a metasomatic change or replacement, such as suggested by Becker for the genisis of pyritic impregnations in the altered rocks of the Comstock Lode in Nevada, by the action of hydrosulphuric acid solutions on ferruginous bisilicates.[1]

The presence of free gold in the soft slates at the Burns and Howie mines, above alluded to, might be explained as a residuum from such auriferous pyrites, the iron sulphide having been oxidized and leached out.

Mr. Becker has pointed out the tendency to successive deposition from solutions reaching complete saturation for separate minerals at different points in space.[2] This explanation may be applicable to the local deposition of free gold, unaccompanied by quartz or pyrite, such as is seen in the fine coatings on the cleavage planes of the unaltered slates at the Howie mine.

As a rule the richer ore bodies exist as shoots or chimneys, which have a pitch of their own in the vein, and which must represent the main course of maximum circulation. The position of these shoots may bear some direct relation to the laws of fissuring.

Posepny is inclined to accept "crustification"[3] phenomena as an infallible proof of the ascension theory of vein filling. While this may be disputed, yet in connection with the other facts above pointed out in regard to the deposits under consideration, incrustation can only furnish additional evidence of the manner and sequence of filling.

Several observations of incrustation were made; probably the best example was met with at the Moore mine in Union county, as shown in the accompanying figure (Fig. 1).

[1] Geology of the Comstock Lode and Washoe District; by George F. Becker; United States Geological Survey; Monograph III, 1882, p. 210.
[2] United States Geological Survey; Mineral Resources of the United States; 1892, p. 150.
[3] Mineral deposits on the walls of fissure veins. See Posepny's *Genesis of Ore Deposits*, 1895, p. 11.

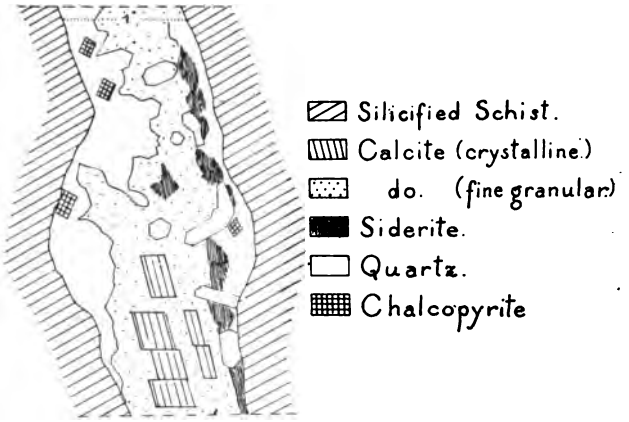


FIG. 1.—Illustrating crustification in a specimen from the Moore mine, Union Co.

It illustrates a narrow fissure containing quartz well crystallized along both walls, with its vertical axis at right angles to the same. The interior is filled with fine granular calcite and some well crystallized calcite rhombohedrons; small specks of a light brown mineral, probably siderite, are distributed in the calcite and against the quartz. The quartz contains crystals of chalcopyrite. Thus, the quartz and chalcopyrite were the first minerals to crystallize out of the solutions, and were deposited in layers or bands on both walls; following these came the siderite and calcite.

In conclusion of this part of the subject it may be pointed out that Emmons' supposition that the gold in the slates and schists is of sedimentary origin (p. 29) is thoroughly untenable. It is true that there is generally in the South, beyond the zone of glaciation, an upper layer of decomposed rock, varying from a few feet to 150 feet in depth. This may be in instances subject to motion and rearrangement whereby the broken down quartz veins, with their gold, may be concentrated, in places forming placer deposits; or the gold may even be distributed quite generally through such a secondary mass (Parker, and Portis mines). But Emmons could not have referred to this alone, for his assertion is too broad.[1]

[1] Geol. Report, Midland counties of N. C. 1856, pp. 57, 64.

AGE OF THE ORE DEPOSITS.

The filling of the dicission spaces took place subsequent to the force producing schistosity. This appears a *fortiori* from what has been said regarding the causes of the formation of the spaces occupied by the ores, and the manner of filling. But an additional proof is offered by the fact that in almost every instance fragments of the slate and schist country rock may be found included in the quartz.

In the extreme southwestern part of the State, Cherokee county, the auriferous quartz veins occur in the Ocoee rocks, and are therefore of Algonkian or Paleozoic age. However, this region is too distant to be used as positive evidence in correlation here. There may have been two eras of vein formation.

The investigations of the Jura-Trias basal conglomerates prove that the origin of the gold must be pre Jura-Triassic. The presence of gold bearing fissure veins in the Monroe slates (p. 36) shows that their age must be post Algonkian or possibly late Algonkian. The existence of ore bodies in the Pre-Cambrian volcanic rocks furnishes additional ground for this statement.

CHAPTER IV.

DESCRIPTION OF THE ORE DEPOSITS AND MINES IN THE CAROLINA SLATE BELT.

MINES IN GRANVILLE AND PERSON COUNTIES.

The belt of copper ores in Granville and Person counties[1] belong here geologically, although it is not our purpose to discuss the copper deposits of this section at any length, except as they may be relative to the precious metals.

All of these copper ores contain both gold and silver, but not in large proportions. The following assays of ore from the Yancey mine, in Person county, will indicate their general character:

Assays, Auriferous Copper Ores, Yancey Mine, Person County.

	(6)	(7)	(8)
Gold, per ton	$ 2.07	$ 2.07	$ 2.07
Silver	8.66	6.98	.65
Total	$ 10.73	$ 9 05	$ 2.72
Copper, per cent	48.17%	26.16%	31.14%

The above cited contents of precious metals is not likely to cut a large figure in the gold mining industry of this section, but they may form a most important item of profit in a well conducted metallurgical treatment of these ores for copper.

It must be premised that neither exploration nor exploitation is advanced enough to allow of more than approximate statements.

Dr. Emmons, in his report,[2] estimated the copper belt to be 5 miles in length, but later examinations make it more than twice that length, for it makes its appearance considerably to the north of the Virginia line, and extends southwest to and even beyond the Yancey mine in Person county.

The belt is almost entirely confined to a ridge, which, with some bends, runs in a course S. 15° W., some thirty miles, nearly to Durham. This ridge, although of no great height, is a some-

[1] Ores of North Carolina. Geological Survey of N. C., by W. C. Kerr and Geo. B. Hanna, 1887, p. 214.
[2] Geology of the Midland Counties of N. C., 1856, pp. 344 et. seq.

what prominent feature in the landscape, and slopes very gradually both to the eastward and westward, and is everywhere strewn with abundant fragments from broken down quartz veins or seams, The schists are very hard and silicified, and the adjacent matter sometimes shades gradually into ore. The strike is from N. 10° to 20° E., and the dip 70° to 80° S. E.

The veins are approximately conformable to the schistosity, and lenticular in structure, varying from a few inches to as much as 14 feet in thickness. The different veins cannot be brought into one alignment, but occupy a belt which at several points is about one mile wide. The ore is quartz, containing chiefly "gray copper" (chalcocite) and bornite, with some red oxide, carbonates, and rarely native copper; chalcopyrite and pyrite occur in small quantities.

The principal mines of this region are the Royster (or Blue Wing), Holloway,. Mastodon, Buckeye, Pool, Gillis, Copper World and Yancey; only the Royster, Gillis and Yancey mines have been largely worked; and at present these are idle.

ALAMANCE, ORANGE AND CHATHAM COUNTIES.

Gold has been found in these counties but no attempts at serious mining have ever been made. Some of the copper ores of Chatham county are auriferous, and may be mentioned in this connection.

In Orange county the Robeson mine (near the old Patterson mine), 12 miles northwest of Chapel Hill, was discovered in 1890. The ore body is a quartz vein, striking northeast and dipping 30° northwest. The outcrop has been traced for a distance of 4 miles northeast and several hundred yards southwest. During the fall of 1895, a prospect shaft was sunk 30 feet on the underlay, and the vein widened from 6 inches on the surface to 22 inches at the bottom of the shaft. The quartz is cellular, vitreous to saccharoidal, and has a good appearance. Various assays have shown from $6 to $52 per ton. Development work is now in progress here, under the direction of Mr. R. E. Lyon, of Durham, N. C.

MOORE COUNTY.

The mines are situated in the northern and western part of the county, not far from the northwest boundary of the Jura-Trias basin.

THE BELLE MINE is in the northern part of the county, 8 miles N. N. W. of Carthage.

The country rock is chloritic schist, sometimes garnetiferous. Small calcite seams also occur. The rock has much the appearance of being a schistose, metamorphosed eruptive; propyllitic alterations were observed. The strike is N. 55° E., and the dip 75° N. W. In the upper part of one of the old shafts the schists were observed to bend over with the slope of the hill, from the normal dip to an anomalous S. E. dip, which was as great as 45° near the surface.

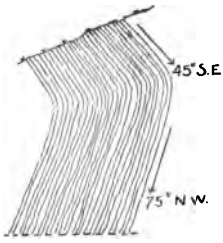


Fig. 2, showing bending of schists, Belle mine.

The mine is abandoned and no ore was visible when the property was visited in 1894. It is stated that the mineralized schists themselves constitute the ore, which exists in several narrow belts containing siliceous seams from ⅛ to 4 inches in thickness. Mr. Richard Williams, the former superintendent, reports that the pay streak was from 4 to 8 inches wide, lying against the foot wall, and that 1½ to 2 feet of the material in the foot wall side was mined and milled, yielding as much as $30 per ton. The entire vein matter, averaging fully 4 feet in width will run $12 per ton. In the course of a professional examination [1] a rigid sampling of the entire ore body explored in the 75 foot level was made. The assays for the two drifts gave the following results:

Assay, Gold Ores, Belle Mine, Moore County.

	(9)	(10)
Gold, per ton	$13.95	$11.37
Silver, "	.62	.35
	$14.57	$11.72

There is very little sulphuret present, and the free gold is very "leafy", which has caused great difficulty in working the ores

[1] By Mr. G. B. Hanna.

by the ordinary modes of amalgamation. In the northwestern part of the county is a group of 9 or 10 mines, comprised in an area 2 miles wide from northwest to southeast, and 6 miles long from northeast to southwest. These limits indicate the productive part, but the actual auriferous area is considerably more extended.

THE BURNS (OR BURNS AND ALRED) MINE is situated 11 miles W. N. W. from Carthage on Cabin creek. The freehold and land tracts comprise more than 300 acres.

The country rock is a sericitic, chloritic schist, in part silicified. The strike is N. 20° E., and the dip 55° N. W.; the joint planes dip 35° S. E.

These schists are filled with quartz stringers and lenticles. It is difficult to say what is ore and what is not, for the rock is everywhere auriferous, though not everywhere capable of being profitably worked.

It is mined in large opencuts, 20 to 100 feet wide, to a depth of about 50 feet. The cuts extend along the strike for a distance of about $\frac{1}{5}$ mile. This is on Moody Hill; some work has also been done on Brown Hill.

The selection of places for exploitation has been almost exclusively determined by the results of mill runs of the ore, or by panning; and while this method of work has been wasteful in some respects, it was probably the best method available. The cuts are scattered about promiscuously, without much evident connection or relation, and are usually very irregular in outline.

It is stated that the average ore yields $2.50 to $3 per ton, free gold; and at intervals schists of high grade have been found, and may be encountered at any time.

Iron sulphurets also occur in the schists, but they have not yet been treated, as little, if any, of the work extends below the water level. The rock is also intersected by quartz veins in all directions, but they are presumably barren. Some of the quartz contains included fragments of the country schist. Several interesting specimens were exhibited by the superintendent at the time of our visit. These were small pieces of the soft, unsilicified schist, also free from quartz stringers, containing free gold.

The mill house is equipped with 5 Crawford mills, which treat 8 tons of ore per 24 hours. Three of these were in operation (Nov., 1894).[1] This mine has been operated for more than 40 years. Under the old, and for the most part successful, methods the work was on a small scale, the machinery inexpensive, the capital small, the management economical, and the attention to business was unremitting. And these circumstances will not unfairly indicate the conditions of successful work for all the mines of this group in the future.

THE CAGLE MINE is situated about ¾-mile north of the Burns, and the country rock and ore are similar. The strike is N. 27° E., and the dip 55° N W. The mine was formerly operated by a series of inclined shafts, on the dip, to a depth of 160 feet.

The results of a series of assays of the ore from this mine show:

Assays, Gold Ores, Cagle Mine, Moore County.

	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Gold	$5.17	$39.27	$26.62	$7.75	$6 20	$7.23	$47.54	$4.14
Silver	.18	.70	.66	trace.	trace.	.06	1.10	.13
	$5.35	$39.97	$27.28	$7.75	$6.20	$7.23	$48.64	$4.27

THE CLEGG MINE is ¼ mile west of the Cagle, on the west side of Cabin creek. It has the same character of ore, though the body is larger, and of relatively lower grade. It has been worked by open cuts.

THE BROWN MINE is on the northeast edge of the district, on the road from Moffitt's to Richardson's mill. It has been worked for a distance of 300 yards, and to a depth of 40 or 50 feet. The dip is very flat; the ore body is three feet thick, but the "pay streak" was a comparatively narrow seam of rich quartz, which, it is stated, finally narrowed down to such limits that it could not be profitably worked.

RANDOLPH COUNTY.

THE HOOVER HILL MINE[2] is situated about 17 miles a little east of south from High Point, on the waters of the Uharie river, and on the western flank of the northern extension of the Uharie

[1] In 1895 this plant was abolished by the Cabin Creek Mining Co., and a ten stamp mill with concentrating machinery erected, which it is proposed to use in connection with a cyanide treatment.

[2] Geological Report of the Midland Counties of North Carolina. E. Emmons, 1856, p. 139.

mountains. The mine has only been worked spasmodically during late years. Unfortunately the water was up on the day when recently visited, and the underground workings were not open to examination.

The country rock is a decomposed basic eruptive, which is partially brecciated, the included fragments being hornstone. Masses of hornstone, containing sulphurets, were also found, resembling that of the Silver Valley mine (p. 66). As at the Silver Valley and Silver Hill mines the basic rock is somewhat schistose in structure. It is probably a quartz porphyrite. Certain more or less definite belts of this rock are intersected by innumerable small reticulated quartz veins, from less than one inch to one foot in thickness, and this is the material that constitutes the ore. The weathered outcrops were extraordinarily rich and gave the mine its early fame. At greater depths the gold is invariably associated with the quartz seams, though quartz sometimes occurs without enriching the ore body. Sulphurets (iron pyrites) are present to the extent of about 3 per cent.

The principal ore body is known as the "Briols shoot," entered by the Briols and Gallimore shafts, the former being 350 feet deep. The ore body at this depth was large; its width was 12 feet, and its length 70 feet or more; it was worth $8 to $10 per ton. At no great distance from the Briols, six other bodies lying quite closely together have been worked by the Hawkins shaft.

The Wilson Kindley Mine is situated ½ mile southwest from the Hoover Hill, and the formation is like that of the latter mine.

The Jones (or Keystone) Mine[1] is situated 18 miles E. S. E. from Lexington and 12 miles S. S. E. from Thomasville. The country rock represents a very schistose phase of the brecciated porphyrite found at the Hoover Hill mines. It is very soft and decomposed, so that the iron sulphuret, with which the rock is charged, has given rise to pure limonite which has filled the joints and cross seams, and in fact stained the whole mass a reddish brown color. The strike of the schistosity is N. 45° E.,

[1] Geological Report of the Midland Counties of North Carolina. E. Emmons, 1856; pp. 131, 132.

dipping 80° N. W. Besides the suiphurets, this schistose rock is filled with fine stringers of quartz. The ore bodies consist of this quartzose, pyritic mass.

Gold is universally present in the soil of the region, but mining is confined to certain well known belts, which are more richly charged with it. Occasional horses (or "bars") are found charged with finely disseminated iron pyrite, and being as yet slightly altered, are still solid and firm; these (unless very rich) are usually avoided from the comparative difficulty both of mining and milling. Two of these belts have gained especial prominence, one being 50 feet and the other 110 feet wide. But there are numerous openings on every part of the tract, from every one of which auriferous material may be obtained. The portions which are comparatively barren are easily recognized and readily avoided. The mine is a series of open quarries. The tract is everywhere cut by gulches, which allow easy access and cheap entry into the ore bodies, and at the same time facilitate transportation by gravity tramways, to the mill.

The character, the occurrence, and the distribution of the ore, are such, that new bodies, equal in value to any that have been hitherto worked, may at any time be exposed.

The disintegrated condition of the rock allows of mining at a marvelously cheap rate, frequently not exceeding 15 cents per ton of ore delivered in the mill-house.

The material is low grade, but it changes perpetually in its contents, and bodies of relatively high grade material may be met with at any time, but the extent of these rich seams is limited. The assays[1] give:

Assays of Gold Ores, Jones Mine, Randolph County.

	(19)	(20)	(21)	(22)	(23)
Gold per ton	$ 3.10	$ 6.20	$ 2.58	$ 3.10	$ 2.07
Silver " "	.10	trace	trace	.03	trace
	$ 3.20	$ 6.20	$ 2.58	$ 3.10	$ 2.07
	(24)	(25)	(26)	(27)	(28)
Gold per ton	$ 28.94	$ 4.15	$ 2.07	$ 4.15	$ 4.82
Silver " "	trace	trace	trace	.13	.13
	$ 28.94	$ 4.15	$ 2.07	$ 4.28	$ 4.95
	(29)	(30)	(31)	(32)	(33)
Gold per ton	$ 4.14	$ 3.10	$ 2.89	$ 4.14	$ 3.61
Silver " "	trace	trace	trace	trace	trace
	$ 4.14	$ 3.10	$ 2.89	$ 4.14	$ 3.61

[1] By G. B. Hanna.

Strict averages of large bodies of accumulated material, or reserves easily accessible, gave fairly uniform results, so that it may be said with fairness that the average value of working bodies will not fall under $3.00 per ton.

Sample No. 24 above was taken by accident from a place which did not in the slightest degree indicate any superior value.

Mining has been carried on here for two generations, and as long as the rich shoots and the concentrated material lasted, it was profitable, but when the resources worked down to the low grade ore, the old methods were no longer applicable, and the work became fitful.

In the open cut where the present (Nov. 1, 1894) operations are being carried on, the width of the ore bearing schists is 12 to 15 feet. A ten stamp mill stands on the property and the ore is stated to mill $2.00 per ton.

One of the prime conditions of success with low grade mine stuff of this character is the handling of large quantities. A combination hydraulicking and milling process (Dahlonega method) might be applicable here. The nearest supply of water is the Uharie river, a bold stream, some 2 miles away, but at a lower level.

The Parish Mine, now abandoned and inaccessible, is situated about ¾ mile southwest from the Jones. The country rock is similar to that at Hoover Hill, though more decomposed. It is schistose in structure and shows brecciation. The ore body is mainly actinolite which is auriferous.

The Lafflin (or Herring), and Delft Mines are situated in the vicinity of the Jones, and are similar to that in the character of their ore bodies.

The Winningham and Slack mines are in Randolph county, two and a half miles south of Ashboro.

The Davis Mountain Mine is four miles southwest of Ashboro.

The Sawyer Mine is five miles northwest of Ashboro. At this locality the ore body is massive and consists of parallel belts of silicified schists in an advanced stage of disintegration, and sometimes forming a body of fine, loosely coherent sand. These

schists are auriferous, and the workable bodies are sufficiently near each other to be worked at the same time.

The Winslow is five miles southwest of Ashboro.

THE UHARIE MINE is a short distance to the northeast of the Russell mine, (see p. 74), just over the line in Randolph county. The formation is for the most part the same as at the Russell, and calls for no detailed description. The entire mass of gold bearing schists is believed to carry 1½ per cent. of pyrites. Unlike the Russell mine, the former work here was underground. The shaft was sunk to a depth of 170 feet.

DAVIDSON COUNTY.

THE EMMONS (OR DAVIDSON) MINE is situated 15 miles southeast of Lexington. The country rock is a soft chloritic schist, striking N. 22° to 31° E., and dipping 40° N. W. These schists contain small quartz veins, approximately conformable with the lamination, from a few inches up to one foot in thickness, and the whole material is mineralized with sulphurets (mainly chalcopyrite, with some galena, sphalerite, and pyrite). Siderite and chlorite occur as gangue minerals. The total thickness of the ore body is stated to be from 3 to 8 feet. The ore shoots pitch to the southwest. The ore is only slightly auriferous and has been worked entirely for its copper contents. The mine is entered by two shafts 680 feet apart, and both in the lode. The deepest shaft is 416 feet deep on the incline. Levels occur at 200, 280, 350 and 410 feet. It was reopened and worked several years after the war by a Baltimore company. The Hunt and Douglas (old) process was used here successfully for a long period. The available supply of ore was exhausted, according to a statement of James E. Clayton, then superintendent, and the mine closed down. In 1885 and 1886 it was again operated for a short time.

THE CID MINE is 1¼ miles northeast of the Emmons. The appearance of she schists and the general character of the ore resemble the conditions at the Emmons. It carried from the start rich copper ores; chalcopyrite, with black oxide and other surface alterations. The surface ore carried from 5 to 15 ounces

of silver, with a little gold (for which it was first worked, but without much success).

An underlay shaft was sunk 100 feet, when, from some unascertained cause, work was stopped.

THE SILVER HILL MINE[1] is situated about 10 miles southeast from Lexington. The country rock is chloritic schist, striking about N. 35° E., and dipping 57° N. W. Specimens of an eruptive dike rock were found, apparently pyroxenic in composition; and other specimens of the same rock show a fibrous, asbestos-like mineral; still other specimens exhibit a fine grained, silicified phase. One large piece showed a contact between the coarse eruptive and the country schists, along which occurred a coating of zinc blende. The dike rock also contains fragments of schist. The schists are impregnated with sulphurets (pyrite up to ¼″ cube, and also galenite and sphalerite).

The two principal veins or lodes are know as the "East" and the "West;" they are parallel and about 28 feet apart on the outcrop. The strike is N. E. and S. W., and the dip is N. W., in the vicinity of 45°.

The prevailing appearance of the upper part of these lodes, and their accompaniments, is a yellowish white, decomposed, material, varying from hard rock to rotten schist and soft clay, and with the mineral matter dispersed through it, and not readily distinguishable.

The gossan is composed of the usual decomposed sulphurets and was at first worked for gold. The treatment of the ores for gold, however, did not continue long, for the real character of the mine speedily disclosed itself. Below the water level the ores become a complex mixture of sulphurets, chiefly galena and zinc blende, with some chalcopyrite and pyrite, and the principal precious metal content is silver.

From the imperfect records of the mine now accessible it is believed to have been discovered in 1838. It has been more extensively worked (the Gold Hill excepted) than any other

[1] Geological Report of the Midland Counties of North Carolina. E. Emmons, 1856, pp. 183-193.

mine in North Carolina. The last work was done about 12 years ago, since when the mine has been closed and inaccessible.

The mine, during the thirty years of its active work, was practiced on by all kinds of "process" mongers, and the grounds and buildings are a museum of old and nondescript machinery and metallurgical appliances. A mechanical separation of the galena and blende by buddles and similar concentrating machinery was probably the nearest to success of any of the methods adopted here; but assays of the tailings and slimes show a great waste of valuable constituents. The ore was for a time used without separation of the galena and blende in making white paint, and served, it is believed, an admirable purpose. The ore is essentially adapted to a smelting process in combination with copper ores, such as was successfully tried some 3 years ago on similar ores from the Silver Valley mine. (See p. 66).

Plates Nos. II and III show all the important underground features. Down to the 200 foot level the drawings are from actual surveys by R. C. Taylor and Jas. V. Symonds; below that point they are made from notes and statements by the old superintendents and underground bosses, especially Mr. James Prim, and are to be regarded as only approximately correct. No records of a survey of this lower part of the mine exists.

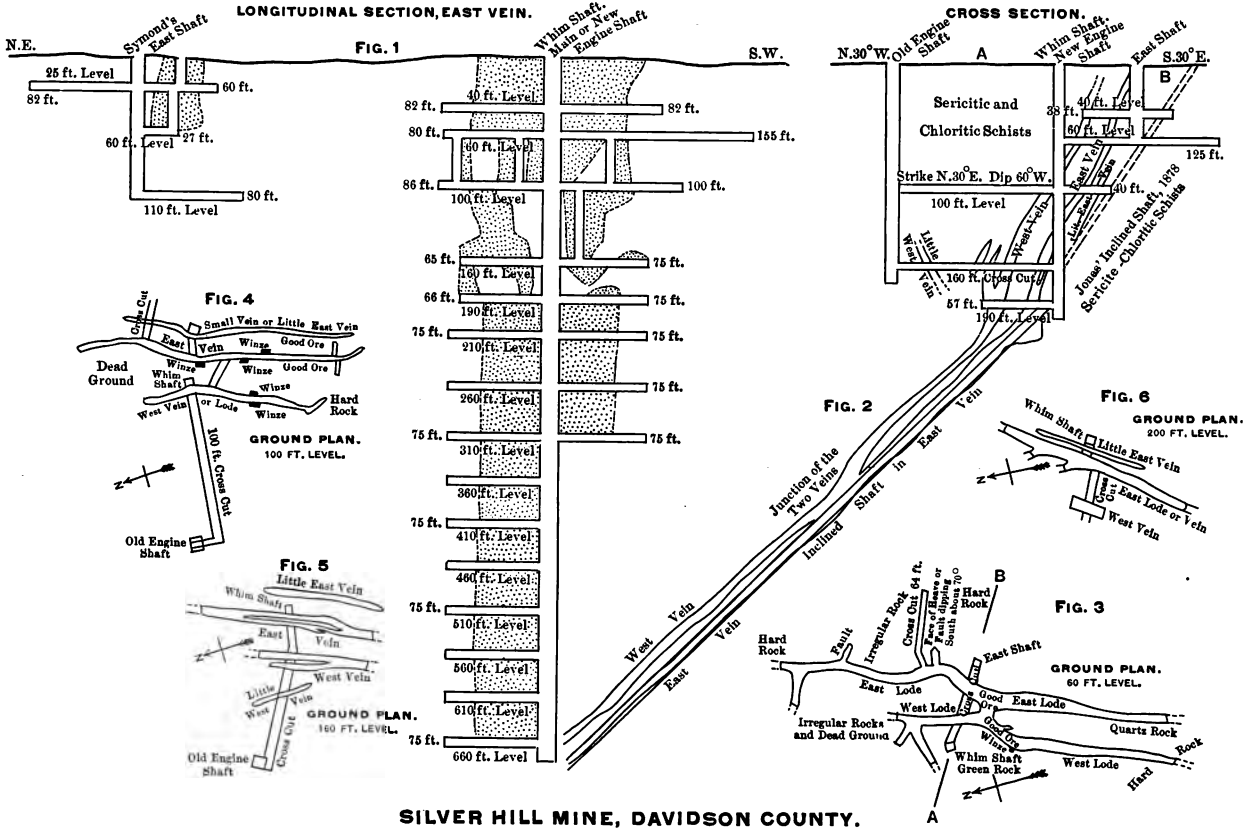
Much the greater part of the ore has been taken out by the Engine shaft (at first known as the Whim shaft). Down to 200 feet this shaft was vertical; from the 190 foot level of this vertical shaft an inclined shaft was sunk to a nominal depth of 660 feet; this incline was in the back or east vein, and in the main followed the dip. Both veins were worked from these shafts, as shown in plate No. II, in the vertical section through the engine shaft.

The mine has been more or less prospected for about 700 feet of its entire length, but the vein formation extends a much greater distance, as is shown by the following assay of ore from the north extension:

Assay, gold ore, north extension, Silver Hill, Davidson county.

(24)

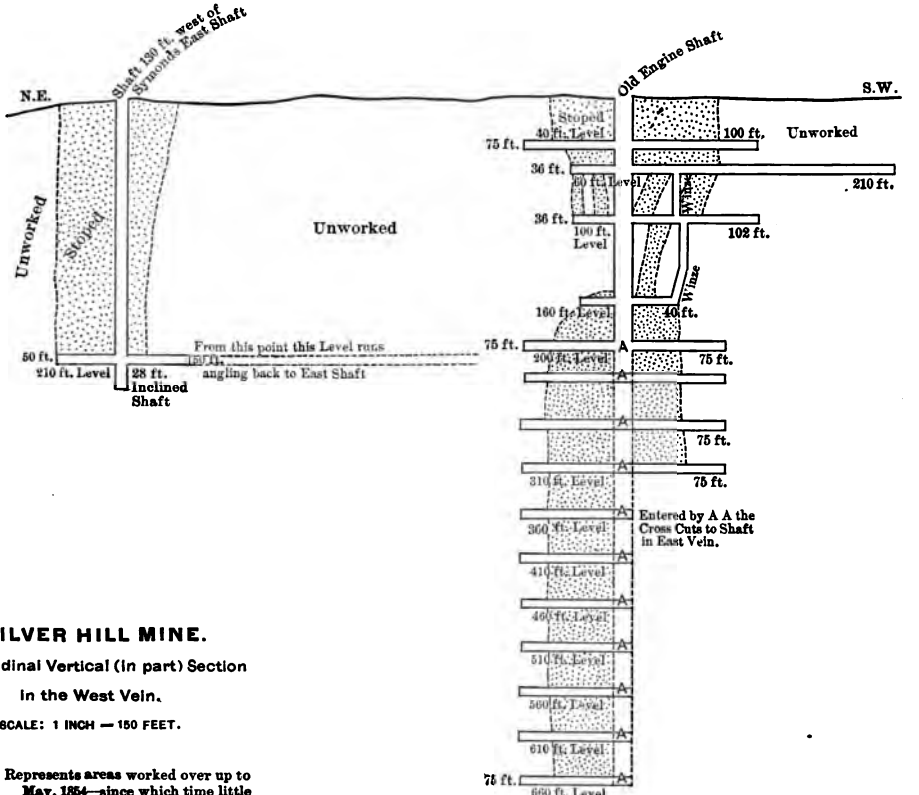
Gold, per ton	$10.33
Silver, per ton	12.28
	$22.61



SILVER HILL MINE, DAVIDSON COUNTY.

Stippled spaces and the ground plans showing the area worked out up to May, 1854. Scale: 1 inch = 150 feet.

ENG'D BY AMERICAN BANK NOTE CO., N.Y.



SILVER HILL MINE.

Longitudinal Vertical (in part) Section

in the West Vein.

SCALE: 1 INCH — 150 FEET.

Represents areas worked over up to May, 1854—since which time little work has been done.

ENG'D BY AMERICAN BANK NOTE CO., N.Y.

The East vein above the 60 foot level was the richer in silver, and the West vein in lead, hence the former was called the "Silver vein," and the latter the "Lead vein." The space between was soft ground with disseminated mineral matter.

Two small veins are found from 100 to 175 feet in depth; the Little East vein, a few feet east of the main East vein, and nearly parallel to it; and the Little West vein, some 50 feet west of the main vein, and inclining toward it. Small outlying lenticles were encountered occasionally in driving into the "country," and the main vein was occasionally divided by "horses" of slate.

The veins come together at the 60-foot level just to the southwest of the engine shaft (plate II, fig. 3), where the West vein was the richer in silver. At the 60-foot level, and down to the 100-foot level of the West vein, there also occurred a good body of manganese ore, and associated with it most of the cabinet specimens for which this mine was noted; e. g., carbonates, sulphates, and phosphates of lead, and carbonates and silicates of copper, together with foliated and other kinds of native silver; the East vein was less rich in cabinet specimens.

The West vein also expands considerably between 60 and 100 feet; but in the expanded parts it was regularly defined, and often had "vugs" with rich mine matter. In this zone the ore was changed from oxides to sulphides, with blende predominating over the galenite. Below the 160-foot level the East vein again becomes richer in silver.

At this depth the space from wall to wall of the two veins (i. e., foot wall of East vein to hanging wall of West vein) is 32 feet, and the vein becomes more vertical, i. e., 64° from the horizontal, and sometimes expands into nests, and is frequently filled with black, cellular, steel-grained, zinciferous ore, with occasional masses of rich argentiferous galenite, and native silver. Assays of this ore show:

Assays, Silver Ore, Silver Hill Mine, East Vein, Davidson County.

	(25)	(26)
Silver, per ton	$ 25.86	$ 103.44
Lead, per cent	49	52

Galenite, associated with minerals of secondary formation, is sometimes found ranging extraordinarily high in silver.

For 160 to 200 feet the vein becomes still more steep, but at the latter depth rapidly changes to approximately 45°. Near the 200 foot level the West vein is ten to sixteen feet thick, and is filled with argentiferous galenite—the last ten feet having produced more silver than any similar distance from the 160 to the 200-foot level.

The east vein is divided by a "horse", at the 160-foot level, as shown on plate II. Both the Little East and the Little West veins carry ores quite like those of the main vein at the same depth.

Below the 200 foot level the blende gradually increases, and finally predominates over the galenite.

The composition of a large pile of ore, which had accumulated with reference to smelting, was as follows;

Assay, Ore From Silver Hill, Davidson County. (27)

Lead	17.5 per cent.
Zinc	45. "
Sulphur	25. "
Iron oxide, alumina and silica	10. "

All efforts to smelt this class of ore were disastrous and wasteful.

At 170 feet the richest ore was found in a lenticle in the general mass, two feet thick. At the depth of about 200 feet a huge shoulder or swell was encountered, making the floor nearly flat for awhile. Below 200 feet the vein and its walls assumed their permanent and normal characteristics.

The inclined shaft was sunk in the East vein, and cross-cuts driven from it to the West vein, and through them the West vein was worked, levels being driven each 50 feet on the incline. Down to 310 feet the levels extended both northeast and southwest; below 310 feet, 50 to 75 feet to the north only, since the shoot of ore appeared to be pitching to the northeast. The stopes extended 25 to 50 feet from the shaft along the levels, both veins being worked alike. At the depth of about 400 feet, the exact point not being now ascertainable, the two veins uni-

ted again, and continued together for a distance of 50 feet downward.

The ore shoots appear to be diminishing in length at the deepest point thus far attained, and are about 25 feet long in the course of the vein, but the thickness is not materially changed, and they have a width of twelve feet. Those who have been long familiar with the mine, say that it is a repetition of what has often occurred, and are sanguine that it will enlarge again.

It is believed that a large body of carbonates still exists near the surface, and down to 100 or 200 feet. This body was penetrated by the late J. Howard Jones in 1878, and a large amount of ore brought to the surface. Its character is indicated by assays Nos. 28 and 29 below. The general position of Mr. Jones' inclined shaft is shown on plate II by dotted lines; an extensive cave subsequently occurred, and its exact position cannot now be determined.

It may be mentioned that bodies of iron pyrite, with a very little chalcopyrite, are sometimes encountered, and it is believed that a considerable quantity exists. Assays Nos. 30 and 31 show its composition. Nos. 32, 33 and 34 are assays of compact galenite.

No. 35, by Prof. F. A. Genth, is the average contents during his connection with the mine, being an average of some 200 assays.

Assay, Ores from Silver Hill Mine, Davidson County.

	Carbonates.		Pyrite.	
	(28)	(29)	(30)	(31)
Gold, per ton	$ 8.27	$ 2.07	$ 3.10	$10.34
Silver, " "	20.36	4.65	4.01	2.97
	$28.63	$ 6.72	$ 7.11	$13.31
Lead, per cent	3.8 per cent	31.94 per cent	0.67 per cent	———
Zinc, " "	———	27.28 per cent	2.08 per cent	———

Assays, Compact Galena, Silver Hill Mine.

	(32)	(33)	(34)
Gold, per ton	$ 4.13	$ 6.20	$ 4.13
Silver, " "	3.23	10.73	11.25
	$ 7.36	$16.93	$15.38
Lead, per cent	22.94 per cent	56.72 per cent	12.57 per cent.
Zinc, " "	7.14 per cent	———	34.29 per cent.

General Average of 200 *Assays, Silver Hill Ores.*

	(35)	
Galenite	21.9	per cent.
Bisulphide of iron	17.1	"
Sulphide of zinc	59.2	"
Silver and gold	.025	"
Copper pyrite	1.8	"
	100.025	"

Passing to the north along the East vein are the Symonds' shafts, (plate II). Sulphide ores were encountered here near the surface, and were of the same general character. Symonds' east shaft was sunk 110 feet, and the west shaft 210 feet. Very little stoping was done in these two veins. A level was driven from near the bottom of Symonds' west shaft, running angling back to the engine shaft in the East vein.

THE SILVER VALLEY MINE is situated 5 milest northeast of Silver Hill, and 12 miles E. S. E. from Lexington. The character of the ore is very much like that of the Silver Hill mine. The mine was discovered and opened in 1880, and it was last operated in the latter part of 1893, the ore being hauled to Thomasville where it was successfully treated by a smelting process, using copper ores as a flux. A 20 stamp mill stands on the property. The old mine dumps show specimens of argillaceous schist, which it is stated form the hanging wall of the vein, while the foot wall is a hard fine grained hornstone (locally called "gun flint"), which also occurs in abundance on the dump pile. The color of this hornstone varies from a light drab to dark gray, and some specimens show a sharp contact between the two, resembling flow-structure. It has all appearances of being a devitrified volcanic rhyolite, and this is substantiated by microscopic examination. An eruptive basic rock, resembling that at Silver Hill, is also found here, and from the various statements it appears to exist in the form of a dike.

The presence of galenite was suspected thirty years ago, and much prospecting work was done to find the deposit; but the work was done mostly in the schists some distance off to the west of the present shaft, where the galenite disseminated in the schists seemed most promising. The vein now under discussion was discovered subsequently by a shrewd guess. Its strike is

approximately north and south, with a dip of 45° to the northwest.

The quartz outcrop of the vein is nearly twenty feet wide, and is not the least promising for a mineral formation. The vein is five to twelve feet wide, and presents a laminated structure, with alternate bands of ore, slate and quartz; these ore seams are from three to eighteen inches thick. It is believed that the ore is less scattered and more solid as depth is gained.

The mine is entered by two shafts, one vertical and one underlay in the vein of 170 feet (equivalent to about 120 feet vertical), and levels have been run 100 feet in either direction from the foot of the inclined shaft, which are mostly in ore.

The contents of the vein is a milk-white and barren looking quartz, which disclosed little mineral matter until a depth of sixty feet was reached, though the upper part contained some brown ore.

The ore is very like that of Silver Hill in its lower levels, and blende has come to form a large, and in some cases, the predominant constituent. The subjoined assays will show the composition of the massive galenites and blendes.

Assays, Ore from Silver Valley Mine, Davidson County.

	Galenites and Blendes.		
	(36)	(37)	(38)
Gold per ton	$ trace	$ 4.13	$ trace.
Silver " "	17.19	176.49	38.14
	$ 17.19	$ 180.62	$ 38.14
Lead, per cent	15.54%	55.25%	38.8%
Zinc " "	31.43%	11.24%	32.0%

	Poor Concentrates.	Good Concentrates.	Second Concentrates from Poor Ore.	Second Concentrates from Solid Ore.
	(39)	(40)	(41)	(42)
Gold per ton	$ 4.13	$ 4.13	$ 1.03	$ 1.65
Silver " "	23.01	44.74	13.08	14.34
	$ 27.14	$ 48.87	$ 14.11	$ 15.99
Lead, per cent	11.18%	47.62%	9.63%	8.13
Zinc " "	27.70%	12 68%	27.84%	33 54

Assay No. 36 more nearly represents the common run of the slightly cobbed ore, and No. 38 the more massive ore; No. 37 is exceptional.

The possibility of concentrating the mine stuff into a smelting product fairly free from zinc is shown in No. 40, but the losses, as concentration has hitherto been practiced, are enormous.

The gold is far from being uniformly diffused, for the presence of a little iron pyrite makes a considerable difference in the gold contents of the concentrates.

THE WELBORN (SMITH) MINE is situated 2 miles west of the Silver Hill, and carries similar complex ores. The mine was never developed sufficiently to indicate its true resources.

The Smith or No. 1 Shaft was sunk in 1882–3 to the depth, as reported, of fifty (50) feet; at ten (10) feet in depth the vein was twelve (12) inches thick, and at thirty-five (35) it was stated to be forty (40) inches thick. The following assays give some idea of the general run of the ores:

Assays, Gold Ores, Welborn Mine, Davidson County.

	(43)	(44)	(45)
Gold, per ton, coining rate	$15.51	$10.33	$5.68
Silver, per ton, coining rate	14.37	4.20	2.26
Total	$29.88	$14.53	$7.94

Sample No. 43, Schist, with iron pyrite and a little copper pyrite and considerable galenite.
Samples 44 and 45, Schist, with disseminated iron pyrite.

Several hundred tons of ore had been accumulated on the dump in 1883, and an effort was made to smelt it, which, as a matter of course, ended in failure, as the ore contained blende.

At the Miller Shaft, three-fourths of a mile north, there were also several hundred tons of ore on the dump; the vein carried compact sulphurets with a trace of copper, and was reported to be 2½ to 3 feet wide.

Other localities have been worked in this vicinity, e. g., the Symonds vein, but the Survey has no authentic deta respecting them.

THE CONRAD HILL MINE[1] is situated 6 miles east of Lexington, the county seat, on the northwest margin of the Carolina Slate Belt, and near its contact with the granitic rocks. The elevation of the hill is less than 100 feet above the adjacent valleys, and with very gradual slopes. The country rocks are fine grained argillaceous schists, often silicified, thinly laminated and much jointed. The strike is N. 10° to 20° E., and the dip towards the northwest at high angles, approaching the vertical.

[1]The description here given of this mine is reprinted with slight alteration from a special report made by Prof. Kerr in May, 1881, which report was published in the Baltimore *Sun* of June 4, 1881. The mine has not been in operation for a number of years past.

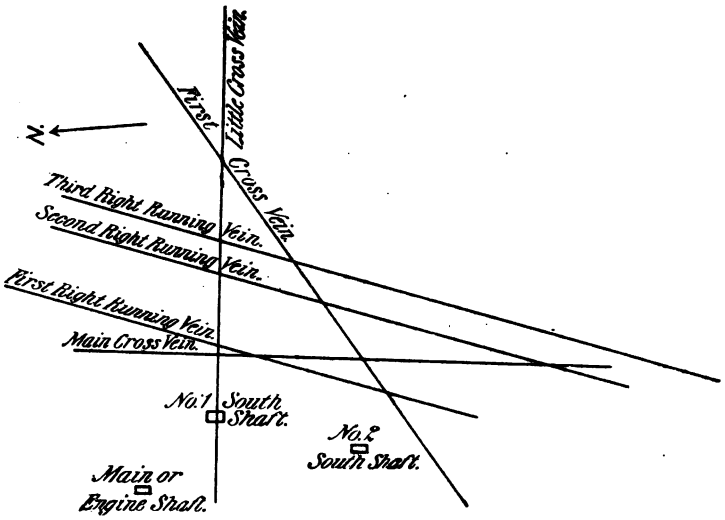


Fig 3.—Plan of veins at Conrad Hill gold mine, Davidson county. *Scale:* about 1 inch to 300 feet. (Largely after Emmons.)

There are two systems of veins traversing the hill (see fig. 3.); one consists of veins parallel to each other and to the strike of the schists, while in dip they frequently, perhaps it may be said generally, cut the schistosity, at a slightly more westerly angle. The second system differs from the first in being entirely independent of each other and of the country rock, in strike and dip.

The former, Prof. Emmons has designated[1] as *right running veins*, and the latter as *cross veins*. The gangue of both is quartz and carbonate of iron. They yield both copper and gold, the former occurring as a sulphuret (chalcopyrite), except in the upper levels, where it has suffered partial oxidation ; the latter occurring as free gold, both in the quartz and in the altered carbonate (brown oxides) of iron of the upper—and in the sulphurets of the lower levels.

Emmons describes four right running veins, which he calls "*first*," "*second*" and "*third*," or "*front*," "*middle*" and "*back*" *veins*, the fourth being considered a branch of the third. The first of these crosses near the top of the hill, striking N. 10° E,, and dipping west at a high angle. The outcrop of the

[1] Geological Report of the Midland counties of N. C., 1856, pp. 143 154.

second or middle vein he places at the distance of fifty feet east of the first, and supposes it to be parallel in dip, as well as in strike, to the first. In this, however, he is evidently mistaken, since the two veins appear to meet within a hundred feet of the surface.

There is evidence in the old workings that still another vein, with a very steep dip, exists between the second and third. This back vein we suppose to cross the line of the South shaft at a depth of less than 130 feet. In its thickness, and in the amount and kind of matter which composes it, he considers this the most remarkable of all the veins of the hill. "It is 15 inches thick at its outcrop, and at the depth of between 60 and 70 feet it is 10 to 18 feet wide. It is quartz above, but at 50 feet carbonate of iron, carrying sulphurets of copper and iron, this part of the vein being four feet thick at the 90-foot level, and rich in gold."

Emmons mentions also 3 cross veins, one as having no outcrop, and only revealed in the engine shaft, and two others which he describes as among the richest of the whole hill. The first of these latter was worked to a depth of 90 feet, and seems to be the one represented as crossing the South shaft, No. 1. The other, having a strike nearly east and west, and a dip south, was worked to a depth of 60 feet, and showed a width of 4 feet of very rich ore, on which a drift of some 60 feet was run. It must, therefore, be the vein which appears on this cross course in South shaft No. 2.

In addition to these there appear to be two other veins, not discovered when Emmons wrote his description—not showing themselves, apparently, on the part of the hill to which his attention was confined. One of these is a very large vein—larger than any of those above described.

The veinstone is quartz and iron carbonate, carrying copper pyrite and gold. This vein is exposed in all three of the shafts, below the point where the other veins are cut—below 100 feet. It is not clear where this vein comes to the surface, or whether it is put down on the sketch as the *main cross vein*. The other new vein is indicated on the diagram to the west of, and parallel to

the first or front vein. It has been opened by several shallow pits, and shows a four-foot quartz vein, with visible gold. An unsorted sample of the excavated mass yielded, in an assay by the company's chemist, $31 per ton for gold.

There are three shafts sunk on the property, as shown in the diagram, and as they are all in front of the right running veins, these will all be penetrated by each of them at the same depth. In No. 1 South shaft, Emmons estimated that the last of them, the back vein, would be cut at 130 feet. A large body of ore was entered at the depth of 98 feet, where, according to Captain Edward B. Wilder, the front and middle veins have united and form one mass. From this shaft, at the depth of 105 feet, a drift was run some 40 feet north and 90 feet south, along and in this body of ore, exposing a thickness of 5 to 10 feet, all of which "contained gold in paying quantities."

The veinstone is quartz, iron carbonate and spongy brown oxide of iron, carrying free gold and copper sulphurets and carbonate. In the lowest part of this great mass of ore, the richer portion, about 4 feet wide, separated from the remainder of the vein by a well-defined line of demarkation, will all assay high —up to $300 per ton.

* * * * * * * * * * * *

Just south of the shaft, a cut has been made from the drift, across this body of ore, measuring some 37 feet, to the foot wall, giving a thickness of upwards of 20 feet. A large part of this thickness is composed of crushed slates filled with strings of quartz. A sample taken across this section, which is 10 to 15 feet high, including slates, quartz and everything representing the whole body of the vein, yielded $22.73 per ton (Hanna). Of course by a process of selection, throwing out the poorer masses of quartz, spar and slate, the yield per ton might be doubled or increased even to a higher percentage.

Just north of the No. 1 South shaft, in the same level, is cut Emmons' second cross vein, which seems to coalesce with the bed of ore just mentioned. There is, therefore, exposed an immense mass of ore, in the mere exploitation of which, by the drifts and

cross-cuts, made in the development of this part of the vein, a pile of material has been accumulated at the surface, which is estimated to contain nearly 3,000 tons of ore, of which an average sample gave Mr. Clausen, chemist of the Conrad Hill Gold and Copper Company, $28.60 per ton.

In No. 2 South shaft, according to Wilder, the veins cut at 67 feet represent the front and middle veins of Emmons. On this point "a cross-cut has been driven 62½ feet back and into the first and second veins, and two levels started, one each way, on the course of the first vein. Both sides of the drift are in good ore, and in the southeast side a course of gold and copper ores, varying from 18 to 24 inches in thickness, has been exposed. Indications are that the ores here are as rich and abundant as at No. 1 South shaft." At the depth of 100 feet a drift has been carried some fifty feet south in a mass of ore, of which only the foot wall is exposed, on which lies an ore course of about 2 feet, the veinstone being quartz and brown oxide of iron, carrying gold and copper. A sample taken along this ore body gives (Hanna) $13.39 gold per ton.

Some forty feet north of this shaft, on the same level, a similar ore course of 12 to 20 inches of prill copper (i. e. 33 per cent. copper) is exposed towards the upper part of the vein, while a stope driven up and along the middle of it, in brown oxide and iron carbonate, gives, by assay of sample representing a thickness of 3 feet, $17.58 for gold (Hanna). This is probably Emmons' second vein. There is exposed in these two drifts a face of nearly 100 feet of ore, with three good ore courses, within a total exposed thickness of the vein of not less than ten feet the hanging wall being nowhere in sight.

Forty or fifty feet more of drifting will connect this level with that coming south from No. 1 South shaft. Emmons' third cross vein is cut in this shaft at the depth of 57 feet, but no new excavations have been made at this level. "At a vertical depth of 103 feet from the surfice this shaft cuts into, and at 122 feet passes through, the main cross vein, proving it to be 17 feet thick at this point, and composed of qnartz and carbonate of iron, with more or less yellow sulphuret of copper. The vein is underlying

at 46°, and the shaft will be continued down the incline of the vein, which has been more thoroughly exposed in the main shaft." This shaft, therfore, opens four important veins, and it is within 40 feet of the new vein, which was recently discovered, and which can also be worked from this direction. The quantity of ore accessible from this point, therefore, and within a very moderate depth, is immense, and this takes no account of the back vein, which, of course. must be reached at no great depth below the present termination.

The Main or Engine shaft is situated 195 feet west of No. 1, and is distant 240 feet from No. 2 South shaft. It was sunk 220 feet vertically, and subsequently to 400 feet. At 163 feet the shaft passes through the main cross vein. Throughout the entire distance a rich course of copper ore is exposed from 3 to 8 feet in thickness, of which 1 to 4½ feet is solid prill ore, giving an average of not less than 2 feet. Samples taken from across the whole distance of the face of this prill, and assayed by Hanna, give $11.98 gold per ton in addition to its copper value. This ore course of prill copper was also exposed, in a thickness of not less than 5 feet, in a drift northwards, at the 175 foot level.

The general course of metallurgical treatment at this time was as follows: The matter was partly sorted out underground, and still further hand-cobbed and picked in the sheds; the richer ore was sent at once to the copper works; the residues, after passing through a Blake Crusher, were jigged, and the best material added to the richer mine stuff above alluded to; the poorest material from the jigs was rejected, the medium grade sent at once to the stamp battery and amalgamated as usual; the tailings from the battery were partly concentrated by buddles and blankets, and the concentrates sent to the copper works.

At the outset, the richer copper minerals were, after roasting, smelted in a shaft furnace for matte, from which, after re-smelting, black copper was obtained and refined. The material, however, was not suited to this treatment, as the necessary basic matter was lacking to make a proper flux, and smelting was superseded by the wet method under the Hunt & Douglas patent (old method), i. e., the crushed ore after roasting was subjected to

a bath of protochloride of iron, for the conversion of the insoluble copper mineral into the soluble chloride; after leaching the copper was precipitated by metallic iron and refined. The residues, now mostly peroxides, were sent back to be milled and amalgamated, and, to a slight extent, concentrated again. The final products were gold bullion and refined ingot copper.

MONTGOMERY COUNTY.

The deep mines of this county have been very prominent in the mining history of the State. The most important group is situated in the extreme northwestern corner of the county, in the vicinity of the village of Eldorado.

THE RUSSELL MINE is situated about 3 miles north of Eldorado, near the Randolph county line. It has been worked more extensively than any other, and has therefore allowed better opportunity for study.

The county rock is an argillaceous slate, both of the soft and silicified types; it also contains small quartz stringers. Some specimens of the silicified slate showed coatings of calcite, and specimens of the softer slates contained small irregular calcite veins; presumably the slate in general is somewhat calcareous. The strike and dip are variable. In the eastern end ef the "Big Cut" the strike of the schistosity is N. 55° W., dip 40° N. E. In a tunnel leading from the cut southward to the open air, the bedding planes of the slates are nearly horizontal, with gentle undulations. In another tunnel entering the hillside, west of the "Big Cut," the strike of the schistosity is N. 24° E., and the dip 56° to 80° N. W. The grain of the slate was determined here; its strike is N. 45° E., and the dip 35° S. W., showing that the cleavage was produced by a force acting from the Southwest downward, and developing normal faulting. The compression was not great. The bedding and cleavage planes usually coincide, but in cases, particularly where the bedding is at a small angle to the horizontal, they do not coincide, the cleavage being much steeper. The cleavage planes are also marked by groovings. Pyrite (with the merest traces of chalcopyrite) to the extent of from 2 to 4 per cent. is almost universally present in

BIG CUT, RUSSELL MINE, GLEN BROOK, N. C.

the slates. It is disseminated in isolated crystals up to ⅛ cube, and also in irregular stringers, lenticles and coatings. The entire formation is gold bearing, but only certain belts are rich enough to warrant mining operations.

To one unfamiliar with the formation, it is difficult to distinguish any difference between the richer and the poorer portions except possibly in the fact that the former are somewhat more altered; and even the miner, long familiar with the region, is often at fault, and ascertains his true course only by constant "panning."

Occasionally the working body jumps abruptly, in one case not less than ten feet, and sometimes further on resumes its old course. The change in grade is even more perplexing, for the external signs of rich and poor ore are of the vaguest kind.

There are at least 6 of these belts within a distance of 2,000 feet across the strike, known as the "Little Lead," the "Big Cut," the "Riggins Hill Lead," the "Soliague Lead," the "Walker Lead," and the "Laurel Hill Lead."

Of these the largest and most extensively worked is the "Big Cut," which is an open cut, about 300 feet long, by 150 feet wide, by 60 feet deep. (See plate IV.)

The ore was mined by blasting down large masses at a time, and the cost of mining was thus reduced to a minimum. On the eastern edge of the cut is a shaft 150 feet deep, from the bottom of which the ore has been stoped upward.

It is stated that the average ore, embracing the entire material from this cut, milled $2.00 per ton. There were some streaks from 4 to 5 feet wide, which went much higher, and portions of the ore were so rich that it was carried out in powder kegs.

The following series of assays shows how wide the variation is:

Assays, Gold Ores, Russell Mine, Montgomery County.

	(46)	(47)	(48)	(49)	(50)	(51)	(52)	(53)	(54)	(55)	(56)
Gold (per ton)	$2.07	$2.07	$3.10	$3.10	$4.13	$5.17	$7.24	$9.30	$9.30	$10.34	$14.47
Silver " "	.06	.26	trace	.22	.10	1.10	.61	.39	.84	1.06	1.55
	$2.13	$2.33	$3.10	$3.32	$4.23	$6.27	$7.85	$9 69	$10.14	$11.40	$16.02

Assays, Gold Ores, Russell Mine (Continued).

	(57)	(58)	(59)	(60)	(61)	(62)	(63)
Gold (per ton)	$22.74	$39.27	$43.40	$84.75	$173.63	$237 70	$320.38
Silver " "	.13	.77	4.29	2.07	3.10	6.31	12.08
	$22.87	$40.04	$47.69	$86.82	$176.73	$244.01	$332.46

A forty stamp mill in good condition is located on the property. The mine was not in operation when last visited in the late fall of 1894; but preparations are now in progress for the erection of a cyanide plant for the treatment of the ores.

THE APPALACHIAN (OR COGGINS) MINE is situated in close proximity to Eldorado. The schists here have a strike N. 40° E., and dip steeply to the northwest; they are quite similar to those of the Russell, though possibly less siliceous or more chloritic.

The mine, as far as developed, shows large bodies of low-grade ore similar to those of the Russell, yet ores that are easily within the limits of profitable work.

At the surface there appeared to be two ore bodies separated by a narrow and comparatively barren bed of schists of like character.

The depth of the last workings was 160 feet. A forty stamp mill stands on the property.

Several assays of the ore show its variation, similar to that of the Russell.

Assays, Gold Ores, Appalachian Mine, Montgomery Co.

	(64)	(65)	(66)
Gold (per ton)	$2.07	$4.65	$113.68
Silver " "	.13	.16	1.29
	$2.20	$4.81	$114.97

THE MORRIS MOUNTAIN (DAVIS OR DUTTON) MINE is one mile nearly west of the Appalachian. The occurrence of the gold is similar to that at the Russell mine. It is occasionally concentrated in the joint planes of the slates, which are sometimes very rich. On account of the small developments, the capabilities of

this mine have never been demonstrated. Assays of the ores have shown the following contents:

Assays, Gold Ores, Morris Mountain Mine, Montgomery County.

	(67)	(63)
Gold, per ton	$3 61	$82.68
Silver, per ton	.68	trace
	$4.29	$82.68

The Riggon Hill Mine is situated 3 miles east of Eldorado. The ore body consists of a quartz vein, reported to be 2½ feet in thickness, lying approximately conformable with the schistosity of the country rock. It has been opened by a prospecting shaft, 100 feet in depth. Rich ores, both in gold and silver, are reported from here.

The Steel Mine, and its extension, the Saunders, are on the east side of the Uharrie river, 2 miles southeast of Eldorado. The nature of the country rock and of the ore deposits are quite like those of the Russell mine.

The ore body varies from 9 to 12 feet in thickness, and occasionally rises to 20 feet. The strike is N. 25° E., and the dip 70° N. W., becoming steeper as depth is gained.

The most valuable part of this deposit consists in what is locally called "string veins"—narrow seams of ore, which run through the mass with some general conformity to the slates. There are usually several of these strings approximately parallel, and from a line to nearly twelve inches in thickness. The combined thickness of these seams is rarely less than 15 inches, and is sometimes more than three feet. There is a considerable proportion of free gold present, but a large part is so intimately associated with the sulphurets as to be refractory to any mere mill process, and will need a smelting treatment. The associated mineral matter is galena, blende, chalcopyrite, and pyrite.

The rich ores of this part of the ore body have, ever since the mine was worked, been called "No. 1" ores, and are so alluded to in all reports. The rest of the deposit has a very small but varying proportion of sulphurets, and is generally rich enough to

justify the treatment of the entire mass. This ore is known as "No. 2".

The remarkable richness of some of these "No. 1" ores is shown by the following assays by Prof. F. A. Genth:

Assays, "No. 1" Gold Ores, Steel Mine, Montgomery County.

	(69)	(70)	(71)	(72)
Gold, per ton	$428.90	$564.70	$2,648.24	$9,665.70
Silver, " "	not det	10.03	51.07	151.54
	$428.90	$574.73	$2,699.31	$9,817.24

Assays of "No. 2" ore, also by Prof. Genth, have shown the following results:

Assays, "No. 2" Gold Ores, Steel Mine, Montgomery County.

	(73)	(74)	(75)	(76)
Gold, per ton	$26.46	$39.27	$55.19	$161.84
Silver, " "	2.53	2.45	2.08	4.60
	$28.99	$41.72	$57.27	$166.44

An examination of these figures will justify the early reputation of the mine for richness. As a matter of course the most ardent friends of the mine do not claim any such values for the ores at the present depth (220 feet). The mine was last operated by the Genesee Gold Mining Company in connection with a 40 stamp mill. The sulphurets were concentrated for metallurgical treatment.

The Beaver Dam Mine is situated at Flaggtown postoffice, 2 miles northeast of the junction of Beaver Dam creek and the Yadkin river. The mining tract contains 800 acres, one-half of which is claimed to be underlaid by gravel. This gravel is from 2 to 4 feet thick and overlaid by an alluvial deposit 5 to 15 feet thick. The bed rock is a decomposed silicified schist.

A fair supply of water is afforded by Beaver Dam creek for hydraulic operations. The fall from the gravel bed to the river, along Beaver Dam creek, is one inch per rod, for a distance of 1½ to 2 miles. Operations on a large scale have always been hindered by the presence of a tenacious white clay, which is commonly mixed with the gravel. Much of the broken down quartz would apparently bear a mill treatment, if an automatic

and cheap process could be introduced as an adjunct to hydraulic mining.

There are large and extensive bodies of greenstone on the property, which contain a sprinkling of iron pyrites, and gener ally a little gold, as follows:

Assay, Pyritiferous Greenstone, Near Beaver Dam Mine.

	(77)
Gold, per ton	$2.07
Silver, " "	.32
	$2.39

This is mentioned to show the extent and character of the diffusion of gold.

THE MORATOCK MINE is situated 6 miles north of the Sam Christian, and 8 miles south of Eldorado. The country rock is a highly silicified quartz porphyry and a brecciated tuff. The quartz porphyry at first sight resembles a compact, homogeneous hornstone or flint, but upon close examination it is found to contain small, black, glassy specks, which are presumably quartz. However, the true porphyritic nature of the rock is clearly brought out in the weathered specimens, the feldspathic groundmass being decomposed and altered, while the quartz remains intact as crystals with partially rounded, but yet distinct hexagonal outlines. Indistinct flow structure is also visible in the fresh rock, and it is emphasized in the ground-mass of the altered specimens. The porphyry contains pyrite crystals up to $\frac{1}{8}$ inch cube, sparingly distributed: (1) irregularly, (2) along small seams, and (3) in minute cavities or geodes. Some chalcopyrite also occurs. The main rock mass is intersected by several small quartz fissure veins, less than one inch in thickness, and these are reported to be rich in gold. The brecciated tuff was not seen in place, but several very large boulders were found in the hillside near the mill. Some of the porphyry fragments in this breccia are as large as 12 inches square. Chalcopyrite and green copper carbonate stains were also noticed.

The Moratock mine was first opened about 2 years ago, and the principal work consists of a small open quarry in the pyritic quartz-porphyry mass. However, the percentage of sulphurets

in this rock is so insignificant that it could never make a workable ore. It is stated that the assays showed less than $1.00 per ton. A shallow shaft has also been sunk in one of the narrow quartz veins. Altogether, it appears only natural that the whole undertaking should be abandoned, as it is. A ten stamp mill, equipped with a cyanide plant, stands on the property.

The Reynolds Mine, 6 miles northeast of Troy, and the *Carter*, a little nearer to Troy, have been worked to the depths of 80 and 100 feet respectively. Little is known of these mines. Both of them contain telluride of gold, according to Emmons.[1]

A belt of gravel mines is found on the west flanks of the Uharie mountains, and between them and the Uharie river. The northernmost limit of these deposits is known to extend to Barnes' Creek in Randolph county, and may even reach to within 5 or 6 miles of Asheboro.

The localities best known and most worked are the Bright, Ophir (or Davis), Spanish Oak Gap, Dry Hollow, Island Creek, Deep Flat, Pear Tree Hill, Tom's Creek, Harbin's, Bunnell Mountain, Dutchman's Creek, and the Worth, the latter being near the junction of the Uharie and the Yadkin.

All of these were largely and profitably worked as long as the naturally concentrated material lasted, and the proximity of water favored work. At present the supply of available water is entirely inadequate for the working of these properties, and the tailing ground is not always favorable. The presence of a tenacious clay with the gravel has also caused difficulties in the treatment. Occasionally a brilliant find of nuggets is made which gives a spasmodic, but short lived, activity to the section, but no large work or permanent activity can be expected, till an abundant and sure supply of water can be secured.

The Sam Christian Mine is situated 12 miles east of Albemarle, and 3 miles east of Swift Island Ford.

This mine has gained something more than a local reputation, and has been productive of remarkably large and fine nuggets.

The gold is found in old "channels", in gravel of a thickness from one (1) to three (3) feet, and deeply covered with soil. It

[1]Geology of the Midland Counties of North Carolina, 1856, pp. 168—169.

is rarely found in the shape of dust, but generally in nuggets of from 5 to more than 1,000 pennyweights.

The tract contains 1,286 acres, and has been worked in several places, especially "Dry Hollow," "The Sam Christian Cut," and "California Cut." Other channels are also known.

The method of work pursued at this mine consisted of a removal of the soil resting on the gravel, followed by a very careful washing of the gravel in sluices and rockers. Where the overlay was slight it was removed by simple digging. In other cases it was washed away by hydraulic giants. The "harvest" periods were uncertain and intermittent; a few days or even a few hours would sometimes suffice for obtaining a large reward for weeks or months of almost unproductive labor. The following interesting table of 40 nuggets, obtained from 1,070 cubic feet of grit in 1880, illustrates well the result from a campaign of 88 washing days:

Weights of 40 Nuggets, Sam Christian Mine, Montgomery County.

Dwts.	Dwts.	Dwts.	Dwts.
430	22	15	41
59	32	11	148
39	22	66	540
167	132 (2 nuggets)	21	240
16	141 (9 nuggets)	13	241
64	26	55	6
1,024	62	48	Total 4,200 dwts.
5	30	484	

The mine was last operated about 1893. Water was supplied from a pumping station on the Yadkin river, some 2½ miles distant, through a line of 20-inch iron pipe. The total elevation of the point of discharge above the water level at Swift Island ferry is 416.8 feet.

The country rock at the Sam Christian is the argillaceous slate of the Monroe type (see p. 36), of which there are some "good exposures" in the "Dry Hollow." A number of strikes were observed here, from N. 5° W. to N. 20° E., with dips from 45° S.W. to 30° N.W., and in places nearly horizontal. The slates show distinct banding, with and at angles to the cleavage. These slates are broken through by large eruptive masses of devitrified volcanic breccia and hornstone, the true field relations of which, however,

could not be satisfactorily determined, but the coarse breccia contains fragments of the hornstone (as large as 4 inches square), and is most probably a tuff agglomerate. The hornstone contains occasional fine particles of pyrite. Its surface weathers with a raised layer of rounded concretions, thus resembling the quartz porphyry at the Moratock mine (see p. 79). Very good exposures of this rock were seen in the "Sam Christian Cut." This eruptive rock contains small quartz fissure veins from ½ to 3 inches wide, striking N. 70° W., and dipping 60° N. E.

Several shafts have been sunk in some of these narrow veins, and it is almost needless to remark that attempts at deep mining on ½ to 3-inch veins were failures. The gold in the gravel came from the breaking down of the numerous small quartz veins in the underlying and contiguous rock. Seven such veins, all less than three inches thick, are shown on plate V, as they are exposed in the upper end of the "Dry Hollow" gulch of the Sam Christian mine.

MINES IN STANLY COUNTY.

The Haithcock, Hearne, and Lowder mines are from 2 to 4 miles northwest of Albemarle, the county seat. The quartz veins of these mines are stated to be from 2 to 4 feet in thickness, lying approximately conformable with the schists. No active work has been carried on for a great many years. Some prospect work was in progress at the Lowder mine during the summer, 1895.

The Crawford (or Ingram) Mine is situated 4 miles northeast of Albemarle. It is a placer deposit of comparatively recent discovery (August, 1892).

The auriferous gravel is situated in the valley of a small stream, and is overlaid by 2 to 4 feet of soil. The thickness of the gravel is from 1½ to 2 feet in the centre of the basin, thining out towards the edges. The width of the deposit is about 250 feet.

The bed rock is slate of the Monroe type, lying in a flat synclinal. The gravel is composed of angular fragments of this slate and white quartz, bound together in a clay matrix. The lack of sufficient water for washing the material on a large and continu-

SMALL QUARTZ VEINS IN DECAYED SCHISTS, AND OVERLYING AURIFEROUS "GRAVEL."—SAM CHRISTIAN MINE.

ous scale presented a serious difficulty at this mine. In 1894 the Crawford Gold Mining Company solved this problem by a very unique device. A wooden tank, holding about 200 cubic yards, is situated at some elevation above the stream bed. At one end of the tank is a stand pipe, about 30 feet high, which is supplied with water from a reservoir below by a steam pump. The gravel, together with a portion of the overlay and bed rock, is hauled to the top of the tank in tram cars, and dumped. Here it is washed by the discharge from the stand-pipe. A line of riffled sluice boxes runs from an opening in one side and near the bottom of the tank. The gold is collected from the bottom of the tank and from the riffles in the sluices. It occurs exclusively in the shape of nuggets, there being no dust gold to speak of.

Two particularly large nuggets have recently been found here, one weighing 8 pounds and 5 ounces, on April 8, 1895, and another weighing 10 pounds, on August 22, 1895.

Some of the gravel is worked directly in rockers, by tributers, who pay a royalty for this privilege.

The source of this nugget gold has not yet been found. On the hillside, adjoining the shallow valley in which the gravel deposit is situated, several quartz veins, from 2 to 3 feet in thickness, have been explored. Pan tests show that the quartz is very slightly auriferous in places, but there is no sign of coarse gold.

The Parker Mine is situated at New London, about 9 miles northwest of Albemarle.

The country slates are those of the Monroe type; they are intruded by successive flows of greenstone porphyry and some more basic eruptives, in part brecciated. The mine shafts have disclosed at least two such eruptive sheets, from 2 to 3 feet each in thickness, lying nearly horizontally and separated by sedimentary slates. In places the greenstone is sheared into nearly vertical schistose masses.

Numberless auriferous quartz stringer veins, from less than one to eighteen inches in thickness, intersect the country rock in all directions. Besides these several larger and more persistent veins occur. The quartz is imperfectly crystallized and often cellular.

Weathering agencies have distributed the gold through the

decomposed rock (soil) to depths of 10 or 20 feet. A combination sluicing and milling process (Dahlonega method) was in operation here at one time; the results, however, were unsatisfactory. The flushed material milled only about 50 cents per ton, although the quartz itself is shown by some assays to run as high as $4 to $6 per ton. It was, however, impracticable to select it.

The principal yield of gold at the Parker mine has been from the old gravel channels. The gold was coarse, and in nuggets. The largest nugget of which there is accurate knowledge weighed 8 pounds, 3 oz , 2 dwts. The aggregate production is estimated at $200,000.00.

The value of the gravel is stated to vary from $0.044 to $2.44 per cubic yard. Although hydraulicking is at present abandoned, the placer ground has not been exhausted. At one point examinations have shown that the bed rock of the gravel channel is a sheet of soft decomposed greenstone but 3 feet in thickness, and that this is underlaid by still another gravel deposit, which will warrant hydraulic operations. The hydraulic plant, which is in good condition, consists of a pumping station at the Yadkin river, 4¼ miles distant, and an iron pipe line to a stand pipe, situated near the mine. The head furnished from the stand pipe to the workings is about 90 feet.

The present work at this mine consists in the development of some of the larger quartz veins. The "Ross" shaft is being sunk and it is expected to intersect an ore body by means of a cross-cut extending eastward from the 120-foot level. Some surface washing is being carried on with the water pumped from the above shaft, the general returns being 80 to 100 dwts. per month. One nugget of 3 ounces was recently found (Nov., 1895).

Some assays of the vein quartz show the following results:

Assays, Gold Ore from the Parker Mine, Stanly County.

	(78)	(79)	(80)	(81)
Gold, per ton	$ 13.43	$ 7.23	$ 4.14	$ 3.10
Silver, per ton	.32	.20	trace	trace
	$ 13.75	$ 7.43	$ 4.14	$ 3.10

No. 78. Quartz vein. Upcast shaft.
No. 79. Accompanying wall rock (schist), 5 feet thick.
No. 80. Flint Spring vein.
No. 81. Other quartz veins.

THE CROWELL MINE is but a short distance from the Parker. The ore body does not differ in a marked degree from the adjacent

"country," for both are auriferous. Both are silicified, sericite and chlorite schists, containing finely disseminated pyrite. The ore body is from 4 to 7 feet in thickness, and will frequently pay to work as a whole. The "pay-streak" is much narrower, and often becomes only a line in thickness. The last workings extended to a depth of 125 feet.

The range of value of the ores is indicated by the following assays:

Assays, Gold Ores from the Crowell Mine, Stanly County.

	(82)	(83)	(84)	(85)
Gold, per ton	$ 7.23	$ 10.23	$ 23.87	$168.46
Silver, per ton	.91	.17	trace	71
	$8 14	$ 10.40	$ 23.87	$169.17

THE BARRINGER MINE is situated 4 miles southeast of Gold Hill. Enormously rich ore is occasionally found, but the mine has been so long and so largely in litigation, that no considerable exploratory work has yet been done. The ore is frequently very deceptive and assays much richer than its appearance warrants, viz:

Assays, Gold Ores from the Barringer Mine, Stanly County.

	(86)	(87)	(88)	(89)	(90)
Gold, per ton	$ 2.07	$ 5.17	$ 5.17	$ 346.23	$ 540.00
Silver, per ton	.26	.26	.32	2.26	4.52
	$ 2.33	$ 5.43	$ 5 49	$ 348 49	$ 544.52

None of these samples differed much in external appearance.

MINES IN ROWAN AND CABARRUS COUNTIES.

THE GOLD HILL GROUP OF MINES.[1] This constitutes one of the most noted mining districts in North Carolina, and has been one of the most productive.

The village of Gold Hill is situated 14 miles southeast of Salisbury on a branch line of the Southern R. R.

The group comprises a number of mines situated in a belt of auriferous schists, lying directly east of the Dunn Mountain granite area, nearly 1½ miles long, from northeast to southwest, and ⅔ mile wide, from northwest to southeast, in the southeast corner of Rowan County, extending over into Cabarrus County on the south, and Stanley County on the east.

[1]Geological Report of the Midland Counties of North Carolina. E. Emmons, 1856, pp. 154, 166, 205, 207.

None of these mines are now in operation and but little can be seen.

The outcrops of the veins were not bold, and in some cases (the Randolph, for example), were so obscured and covered, that they were only discovered by accident, and at a comparatively late date in the history of mining in the State—1842.

This series of mines is situated on the narrow plateau of a low-lying northeast and southwest ridge, which is broken by a small gulch near the Standard mines, and by a still deeper gulch on the McMakin tract, making the surface here quite hilly. The ridge generally slopes gently both to the southeast and to the northwest.

The mines are grouped quite closely together, and very little mineral matter is found to the west of Buffalo creek, which skirts the ridge on the west.

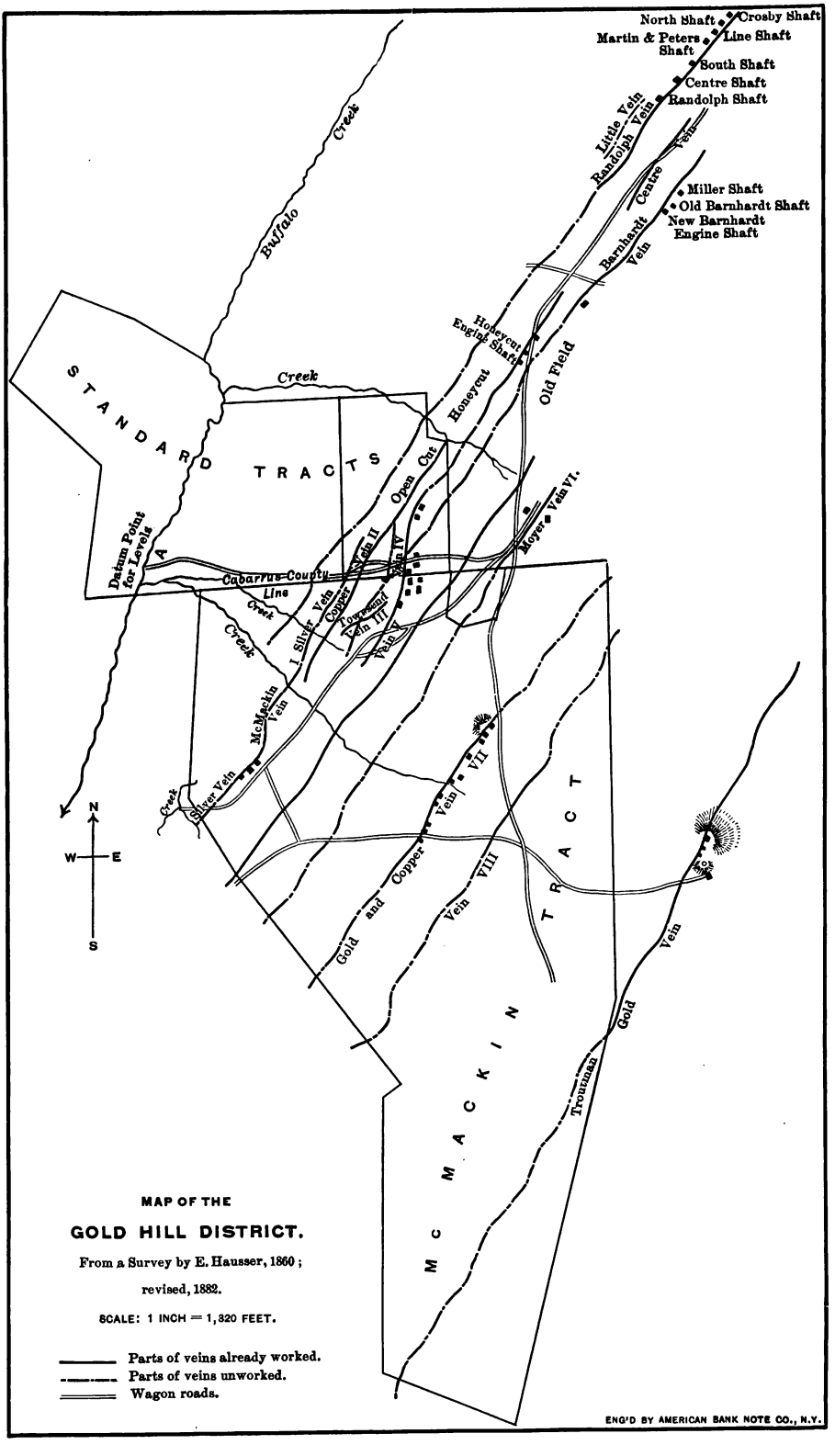
The country schists are chloritic and argillaceous, the chloritic constituent being if anything more marked at the northeastern end, and the argillaceous at the southwestern. The strike of the schistosity is N. 25° to 30° E., and the dip generally 75° to 80° N. W., occasionally vertical, and rarely slightly to the east of the vertical.

A diabase dike, about 15 feet in width, intersects the country in the Randolph and Barnhardt workings. It strikes N. 13° W., and is said to split into two prongs between the Center and Barnhardt shafts.

The character of the ore bodies is that common to the "slate belt" elsewhere. The schists are impregnated, over certain widths, with auriferous sulphurets (pyrite, chalcopyrite and galena) occurring in isolated crystals and small lenticular masses, and accompanied by lenticular stringers of quartz. And these belts constitute the so-called "veins."

The shoots or ore bodies have generally a northerly pitch of their own in the veins, i. e., the workable bodies of ore occur alternating with relatively barren schists, and these bodies tend to the north more and more as the depth increases.

There are at least 10 well-defined veins in the district (see plate VI).



MAP OF THE

GOLD HILL DISTRICT.

From a Survey by E. Hausser, 1860;

revised, 1882.

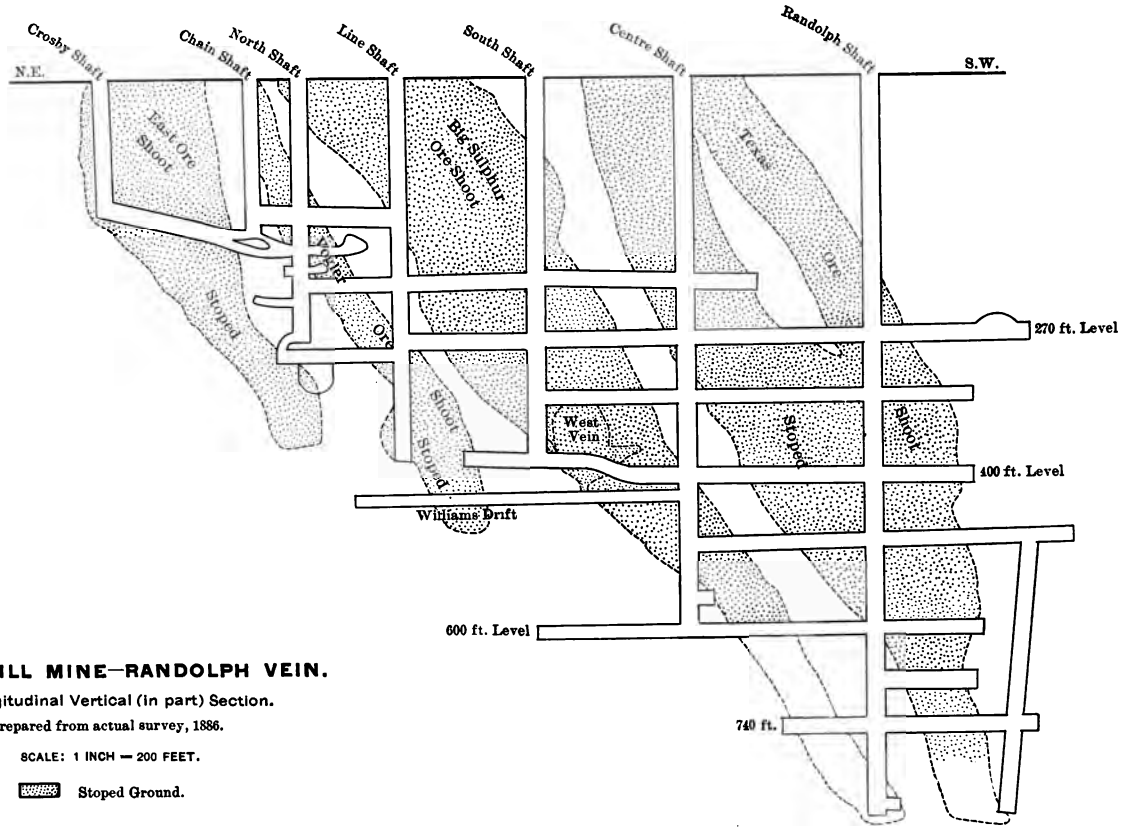
SCALE: 1 INCH = 1,320 FEET.

Parts of veins already worked.

Parts of veins unworked.

Wagon roads.

ENG'D BY AMERICAN BANK NOTE CO., N.Y.



GOLD HILL MINE—RANDOLPH VEIN.

A Longitudinal Vertical (in part) Section.

Prepared from actual survey, 1886.

SCALE: 1 INCH — 200 FEET.

Stoped Ground.

ENG'D BY AMERICAN BANK NOTE CO., N.Y.

Prominent among these are the Randolph, Barnhardt, Hunnicut (Honeycut), Open Cut copper vein on the Standard property, the Trautman gold vein and the McMakin silver vein.

But closely associated with these are outlying bodies, which may also be independent veins—for example, the Old Field body, which is between the Barnhardt and Hunnicut veins, and is made up of several nearly parallel bodies of ore which are very narrow, varying in width from one to several inches, intercalated with the schists and very tortuous.

The Hunnicut vein has been proved for a length of 400 yards, and the Barnhardt for an equally great distance. Most of these veins conform to the schists both in strike and dip.

The *Randolph* (or Earnhardt) *vein* occupies a position on the extreme northwestern edge of the group. It has been worked for a linear distance of 1500 feet, and to a depth of 740 feet. (See Plate VII.) It is this vein, discovered in 1854, which has contributed most to the celebrity of the Gold Hill district, and is in reality *The Gold Hill Mine.* The ore chimneys or shoots are especially marked; they are three in number and extend to the lowest depths to which the mine has been worked.

The Randolph shaft passes through the Texas shoot, just cuts the northern edge of the Big Sulphur shoot, and is but a few feet distant from the Randolph shoot. The ores below the water level are highly sulphuretted, being mostly iron pyrites. The lowest level, at 740 feet, carries considerable bodies of auriferous pyrites, containing (according to Mr. Hambly, a former assayer to the company), about 2 per cent. of metallic copper.

The thickness of the ore body is stated by Emmons (in 1856, when the depth of the mine was 410 feet) to be from 6 inches to 4 feet, and in one part 7 feet.

As respects the value of the ores it is very difficult to speak with exactness, for most examinations and reports have been made with reference to the plans of speculative promotors of mines. Some statements that have been made public are unquestionably too high to be expected from steady work. It is probable that the contents will be of low grade, as compared with the ores nearer the surface.

Some indication of the range of values is given in the following assays:

Assays, Auriferous Copper Pyrites, Gold Hill Mine.

	(91)	(92)	(93)
Silica	52.30 per cent.	—— per cent.	—— per cent.
Copper	0.85 per cent.	2.59 per cent.	5.96 per cent.
Sulphur	16.80 per cent.	—— per cent.	—— per cent.
Iron	23.00 per cent.	—— per cent.	—— per cent.
Gold, per ton	$25.84	$4.14	$5 68
Silver	.49	.71	2.26
Total	$26.33	$4.85	$7.94

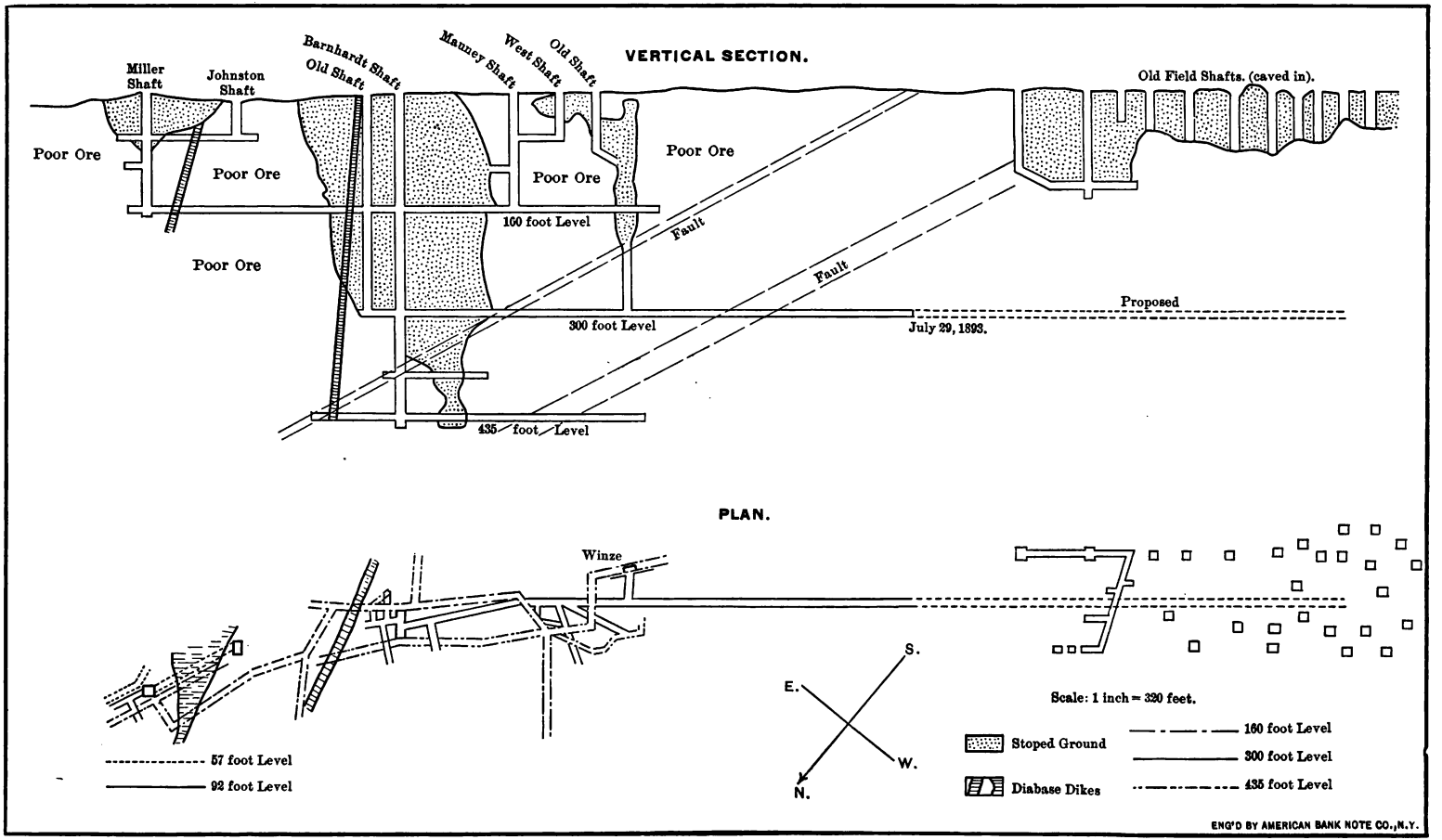
The *Barnhardt vein* (discovered in 1854) is 400 feet east of the Randolph. The ores are similar to those of the Randolph, but in general more cupriferous. (See Plate VIII.)

The *Old Field vein* lies to the southwest of the main workings of the Barnhardt; it consists of a series of ore stringers intercalated in the schists. These seams are frequently of great richness, but the gold "jumps" from one seam to the other so often as to cause some embarrassment in mining. The depth of the last workings extended to a little more than 130 feet.

The *Hunnicut* (Honeycut) *vein* is just to the southwest of the Old Field, and between the Barnhardt and Randolph. It is from 15 inches to 2 feet wide. It was discovered in 1842, nearly at the commencement of the mining excitement in this section, and was worked with great profit for a time, and to a depth of 185 feet. It is stated to have yielded $101,665.00.

The *Standard vein* is still further southwest. It consists of several narrow belts of schists charged with mineral matter. The ore body is very wide near the surface, but at greater depths becomes smaller. The deepest work was at 84 feet.

The *Trautman vein* lies on the extreme southeastern edge of the group. It was the site of the first discovery of gold in this section, in 1842. Down to 20 feet the ores were auriferous, and the deposit was originally opened as a gold mine. The ore was cellular quartz, containing decomposed sulphurets. From 20 to 60 feet down it was a mixture of hematite and highly ferruginous quartz, with a little crystallized pyromorphite, cerussite and other lead minerals; still lower down it was auriferous pyrite and quartz. At the depth of 100 feet, where the sulphurets were



GOLD HILL MINE—BARNHARDT VEIN. ROWAN COUNTY.

unaltered, the ores were poorer and contained a string of ash-grey blende and pyrite, from 2 to 6 inches wide, which had much increased at greater depths. The vein is stated[1] to have yielded $400,000.00.

The *McMakin* (or Silver) *vein* is situated in the southwest part of the district. It has been exploited by pits for several hundred yards, but the deeper workings have extended over a linear distance of about 200 feet only. No work has been done on it for over 30 years. It was entered by 3 shafts, the deepest of which was 180 feet; and two levels were driven, one at 66 feet and the other at the bottom.

There are two veins, designated as the Main vein and the Little vein. They are approximately conformable to the schistosity in strike and dip, viz.: Strike N. 45°–60° E. and dip 70°–75° S. E.

The outcrop consisted largely of brown hematite, psilomelane, pyrolusite, and dolomite—the first and second predominating. Manganese ores disappear at a depth of twenty feet; then plumbago, pyromorphite and cerussite come in; and these in turn go out at 60 feet, being replaced by galenite, blende, pyrite, chalcopyrite, and highly argentiferous tetrahedrite. The prevailing gangue is carbonate of lime and barite with quartz. Down to 70 feet yellow blende, assaying 14 to $39\frac{32}{100}$ oz. of silver, occurs in larger amounts than galenite; then the latter predominates, and is accompanied by an ever-increasing amount of tetrahedrite, and assaying 12 to $53\frac{15}{100}$ oz. silver.

The following statement by Mr. O. J. Heinrich, E. M.,[2] will show the characteristics fully: "At the depth of 76 feet between the South and the Whim shafts the vein is 4 to 10 feet wide, the vein fissure being chiefly occupied by carbonate of lime and barite."

"This gangue carries grains and small masses of tetrahedrite to a width of two feet at the southeast; the central part of the vein contains several seams of tetrahedrite and yellow blende, and the

[1] By Emmons, in 1856.
[2] In a MSS. report to the owners of the property.

northwest has yellow blende with galenite and many grains of tetrahedite. Tetrahedrite is found at its best close to the hanging wall in the southeast." Average samples according to Dr. Genth gave:

Assays, Silver Ore, McMakin Mine, Cabarrus County.

	(94)	(95)
Silver, per ton	$ 317.95	$ 646.50

"Simple cobbing increases the contents," as in assay number 95.

There is a small parallel vein west of the main vein, which has been extensively stoped, from the Whim shaft to the surface; its course is N. 50° to 60° E., and dip 35° S. E. There are probably other parallel veins, both to the northwest and southeast, for the whole belt is metaliferous.

Work was terminated at this mine in 1861, and the vein has not been touched since.

Emmons states that up to 1856 the Gold Hill Mines produced an aggregate of $2,000,000.00.

Up to 1874 it is estimated that $3,000,000.00 worth of free gold had been extracted from the ores, which represents but 20 to 33 per cent. of the assay value of the ores.

Until 1881, when a 20 stamp mill was erected, the mode of extraction was entirely by Chilian mills and rockers. The last regular operations were carried on by the New Gold Hill Company under the management of Mr. Richard Eames in 1893, when ores from the Barnhardt vein were treated in a 10 stamp mill near the mine.

Since that time work at Gold Hill has been of a spasmodic and petty character, carried on by tributers who mill the decomposed material from the old mine dumps, in the Barnhardt mill.

Although the Gold Hill ores are highly sulphuretted, no other treatment than that of simple amalgamation has been attempted to our knowledge. The yield of free gold from these ores has not been more than 20 to 33 per cent. of their assay value, as already mentioned. Chlorination has been advised, and Mr. Eames has made some experiments with cyanide, but they were never carried out on a working scale. It is more than probable that there are

still good ore bodies in the mines; certainly a careful examination is warranted, and improvements in the metallurgical treatment are suggested, namely, concentration of the sulphurets, after battery amalgamation, and subsequent treatment by a chlorination, cyanide or smelting process.

OTHER MINES IN CABARRUS COUNTY.

THE MAUNEY MINE is situated about 1½ miles southwest of Gold Hill, on the opposite side (west) of Little Buffalo creek. The strike of the schists is N. 25° E., and the dip 75° N. W. They are soft and contain but little quartz. The ore-bearing portion is considered to be 4 feet in width. The last work done here (Nov., 1894), consisted in sinking two prospect shafts to a depth of abont 70 feet. The soft brown ores, above the water level, are stated to assay from $2.00 to $6.00 per ton.

THE ISENHOUR MINE is several hundred yards S. 33° W. from the Mauney, and the conditions are practically the same, though there is more quartz on the hanging wall side of the deposit. Work on a petty scale has been prosecuted at this mine during the past years, the ores being treated in a Howland pulverizer, the blanket concentrates from which are washed in log rockers with quicksilver.

Among other mines in this zone of metamorphic schists, lying to the southwest of the Gold Hill region, in the eastern edge of Cabarrus county, are: the Widenhouse, Nugget (or Biggers), Eva Furr, Allen Furr, Buffalo, and Rocky River, all situated closely together, and from 10 to 12 miles southeast of Concord, the county seat.

THE ROCKY RIVER MINE is situated 10 miles southeast from Concord, on the waters of Rocky river. The country rocks are sericitic and chloritic schists, soft, intermediate and highly silicified. The strike is N. 20° E., and the dip (of the schistosity) 70° N. W. There are several parallel quartz veins, which lie apparently parallel with the schistosity, but really cut it at slight angles.

The last work at this mine was done in the summer of 1895, by Mr. Wayne Darlington, E. M., who prospected the property for some Philadelphia capitalists.

The following sketch (fig. 4), shows the position of the veins and the location of the principal former workings:

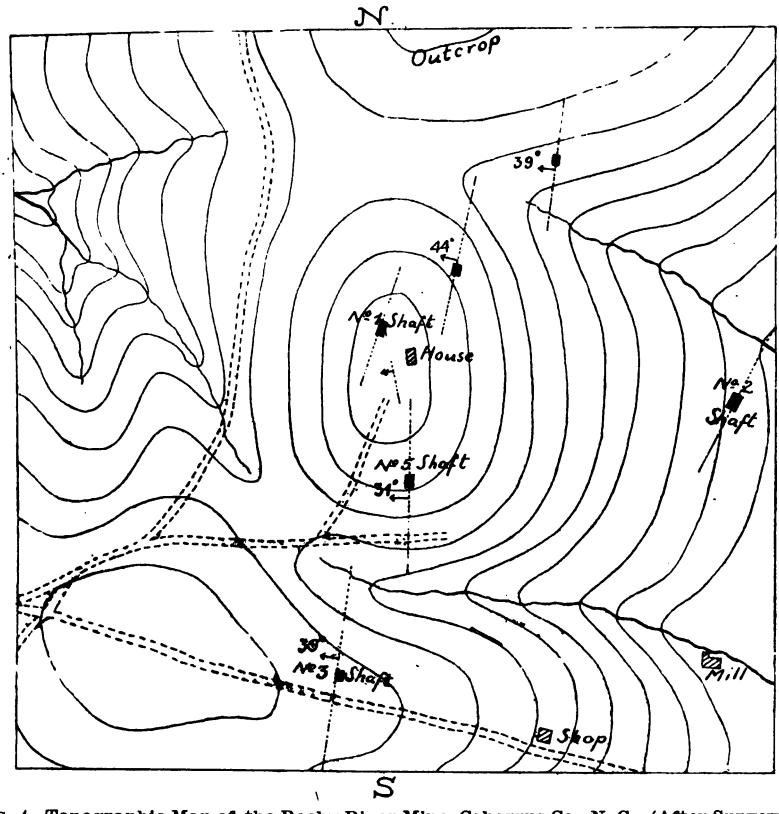


FIG. 4—Topographic Map of the Rocky River Mine, Cabarrus Co., N. C. (After Survey by Mr. Wayne Darlington, E. M. Scale 1 inch=260 feet.

Mr. Darlington's explorations were concentrated chiefly on shaft No. 1, the depth of which is 130 feet, the total length of the drifts being about 200 feet. The strike of the slates is N. 20° E.; dip 70° N. W. The strike of the vein is N. 30° E., dip 85° N. W.

In the 80 foot level the quartz was from 1¼ inches to 3 feet in thickness; in the southwest drift, about 50 feet from the shaft, it was pinched to a few inches. The pitch of the ore shoots is towards the southwest. In the 130 foot level the vein was lost altogether.

Cross cuts in the 80 foot level have exposed several small parallel veins (10 inches and less in width).

The vein matter is mainly quartz, with some carbonates, probably calcite. The quartz carries sulphurets, chiefly pyrite, with some galena, blende, and chalcopyrite. It is stated that about 50

per cent. of the gold in the ores is free milling. Apparently there are three grades of ore: (1) Rich in galena (which carries much of the gold), a smelting ore; (2) Rich in pyrites, an ore to be treated by amalgamation and chlorination; (3) Lean ore.

This quartz ore from shaft No. 1 is stated to run about $15 per ton, the richer branches of sulphurets going as high as $30.

The schists themselves are impregnated with pyrites and small stringers of quartz. In the neighborhood of the larger quartz veins these schists are stated to assay about $3.50 per ton.

At shaft No. 2 the slates are more chloritic; they strike N. 30° E., and dip 70° N. W.

In shaft No. 3 the main vein is stated to be 2 feet thick, and in the foot wall is an aggregate of narrow veins (respectively 8 to 10 inches thick) comprising together a width of about 3 feet.

In shaft No. 5 the vein is stated to be 5 feet thick.

Assays of the Rocky River mine ores show:

Assays, Gold Ores, Rocky River Mine, Cabarrus County.

	(96)	(97)	(98)	(99)
Gold, per ton	$ 5.17	$ 17.05	$ 56.85	$ 64.59
Silver, per ton	1.04	trace	7.18	3.66
	$ 6.21	$ 17.05	$ 64.03	$ 68.25

The recent explorations of Mr. Darlington have apparently shown that the quartz veins themselves, while of good quality, cannot be depended on in regularity of extent. It may be that similar lenticular shoots exist in depth. However that may be, the adjoining schists are known to be auriferous for some distance from the quartz veins, and, taken together with the quartz, may make large bodies of low grade ore.

If the mine were attacked from this view it might be worked profitably.

THE BUFFALO MINE is situated one mile northeast from the Rocky River. The slates strike N. 55° E., and dip 80° to 85° N. W. The main vein is quartz, 5 feet in maximum width. The slates have been cut in a shaft and crosscut over a width of about 25 feet, and found to be pyritic, assaying $3.50 per ton in gold, of which about $1.00 is free gold.

THE ALLEN FURR MINE is 11 miles southeast of Concord, and

near the Rocky River. The ore carries a small proportion of galena in a gangue of massive pyrite; occasionally the galena occurs free enough to constitute a true lead ore. But it is doubtful if any considerable amount proves so rich as indicated by the following assays:

Assays, Gold Ores, Allen Furr Mine, Cabarrus Co.

	(100)	(101)	(102)
Gold, per ton	$ 5.17	$ 6 20	$ 24.81
Silver, per ton	2.58	1.23	26.89
	$ 7.75	$ 7.43	$ 51.70
Lead			34.18 per cent.
Zinc			small per cent.

The great size of the lumps of ore and their richness in pyrites had attracted some attention to the locality as a source of sulphur for the manufacture of sulphuric acid, but later examination have not borne out this expectation.

THE NUGGET OR (BIGGERS) MINE is situated 12 miles southeast of Concord. The country rock is argillaceous slate, which is intersected by basic dykes. An ancient gravel channel of some extent has been worked here for the past two years by hydraulicking. The gold is usually quite coarse and in nuggets. Some galena-bearing quartz veins have been superficially explored, but never developed.

MINES IN UNION COUNTY.

These mines are located in the western part of the county. The ores are readily classified into auriferous and argentiferous galena, auriferous pyrite, and auriferous schists; but sulphurets are never absent from the latter. Copper ores are of incidental occurrence, but are not known to be present in quantity.

THE CROWELL MINE is situated about 14 miles (air line) north of Monroe, in the extreme northwestern corner of the county. The vein matter is cellular quartz, carrying a little galena, some pyrite, and a trace of chalcopyrite.

There are 3 veins. No. 1 strikes N. 30° E., and dips steeply to the northwest. In thickness it varies from 1 to 4 feet. The old engine shaft is 80 feet deep, with drifts 50 feet northeast and 60 feet southwest.

Some assays show the following results:

Assays, Gold and Silver Ores, Crowell Mine, Union County.

	(100)	(101)	(102)	(103)	(104)	(105)	(106)	(107)	(108)
Gold, per ton	$ 3.51	$ 5.17	$ 8.28	$ 9.30	$ 9.30	$ 10.34	$ 32.04	$ 31.00	$ 41.34
Silver, per ton	9.95	1 29	3.46	3 42	10.21	3.55	.32	55 34	4.85
	$13.46	$ 6 46	$11.74	$12.72	$19.51	$ 13.89	$ 32.36	$ 86 34	$ 46.19

The middle vein is 1,000 feet east of and parallel to No. 1, but it is narrower.

Vein No. 2 is 1,500 feet still further east; it varies from 2½ to 4 feet in width; its dip is from 40° to 45° northwest.

THE LONG MINE is ¾ mile southwest of the Crowell, and apparently in line with the easternmost or No. 2 Crowell vein. The strike is N. 50° E., and dip 85° N. W. The vein matter is quartz and schist which carry pyrite, with some galena, sphalerite and chalcopyrite. Calcite and siderite occur as gangue minerals. The thickness of the vein is reported to be 30 inches to 4 feet.

THE MOORE MINE is 3 miles southeast of the Long. The country rock is chlorite schist, which strikes N. 50° E., and dips steeply to the northwest.

The mine has been opened by a shaft 80 feet in depth, but is now inaccessible. The former superintendent, Mr. R. J. Wentz, states that the ore body consists of a quartz vein 5 feet in thickness, approximately conformable to the schistosity of the country rock; and that a four-inch paystreak, composed mainly of calcite carrying free gold, follows the hanging wall.

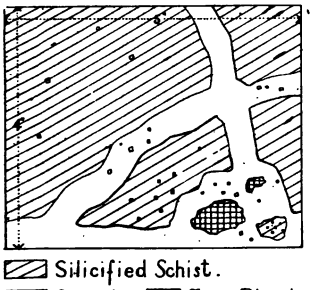


FIG. 5, Showing fragments of schist in vein matter, both containing sulphurets.

The quartz carries pyrite, chalcopyrite, galena and much blende. These sulphurets also extend into the wall rock. The schists are intersected by narrow seams (⅛ inch) of calcite.

Specimens were found on the dump showing fragments of the country schist, highly silicified, imbedded in the vein matter, in both of which are contained small crystals of the sulphurets (fig. 5). Hence the quartz veins were formed in openings in the schist, the whole mass becoming at the same time mineralized.

Other specimens were found showing fissures in the silicified schist containing quartz, well crytallized along the walls, and protruding at right angles to the same; the interior being filled with fine granular calcite, and some well crystallized calcite rhombohedrons. Small specks of a light brown mineral, probably siderite, are distributed in the calcite and against the quartz. The quartz contains crystals of chalcopyrite. (See Fig. 1, page 50.) This shows that quartz was crystallized first around chalcopyrite, and then siderite, followed by calcite. Assays of these ores give the following results:

Assays, Gold Ores, Moore Mine, Union County.

	(112)	(113)	(114)
Gold, per ton	$ 8.27	$ 20.67	$ 124.02
Silver, "	1.52	2.33	116.86
	$9.79	$23.00	$240.88

THE STEWART MINE is situated 1½ miles southwest of the Moore, on Goose creek. The country rocks are argillaceous and sericitic schists. Their strike is N. 55° E., and dip 85° N. W. These schists vary from soft to semi-silicified types, and at times show banding at angles to the schistosity. The ore bodies consist of certain belts of the country rock, impregnated with auriferous quartz stringers and sulphurets (pyrite and some galena). There are three such parallel ore belts, the Asbury, Miller, and Jake. The *Asbury* is farthest southeast, and is reported to be from 4 to 18 inches wide. It has been explored by a shaft 80 feet in depth. The *Miller* is 15 feet northwest from the Asbury, and is reported to be 5 ft. wide. It has been explored by a shaft 185 ft. deep, from the bottom of which drifts extend 100 ft. southwest and 30 ft. northeast, stoped to within 20 ft. of the surface. A cross cut runs from this shaft to the *Jake* "vein," 6 ft. northwest, which has been drifted on 50 ft. southwest and stoped to within 20 ft. of the surface.

In general, the seams of ore are narrow, but there are many of them; and it may be questioned whether the whole series is not one and the same ore belt, with several productive channels. There are also two heavy quartz veins near the Miller and Jake veins, one of them 12 feet wide, but externally not promising.

A ten stamp mill stands on the property, and when visited (Nov., 1894,) was being operated under extremely adverse conditions on material from the old mine dump, consisting of soft, brown gossan ores, which was reported to yield $13 per ton.

Assays of ores containing galena show:

Assays, Ores from Stewart Mine, Union County.

	(115)	(116)	(117)	(118)	(119)	(120)	(121)
Gold per ton,	$ 3.10	$ 8.27	$33.07	$41.34	$41.34	$44.44	$219.10
Silver "	14.09	.93	5.71	6.59	4.01	5.75	5.68
	$17.19	$9.20	$38.78	$47.93	$45.35	$50.19	$224.78

The lead was not determined, but enough was present to form a desirable constituent in smelting.

Other assays from this mine show:

Assays, Ores from Stewart Mine, Union County.

	(122)	(123)	(124)
Gold, per ton	$5.17	$12.40	$20.15
Silver, "	.91	.04	.25
	$6.08	$12.44	$20.40

The future of the mine will probably depend on the possibility of working comparatively low grade ores, and of concentrating the sulphurets for subsequent metallurgical treatment. A very rich shoot of ore was found, but it was subsequently lost, and a great deal of costly work has been expended in searching for it.

The Lemmonds (or Marion) Mine is a southern extension of the Stewart. Prof. F. A. Genth, who had the opportunity of examining the underground work at this mine, describes the vein as follows: " Irregular in size, sometimes widening out from a few inches to 6 feet. It consists of quartz richly charged with brown zinc blende and galenite, with small quantities of arsenopyrite, chalcopyrite, etc."

A pure specimen of galenite which did not show any free gold (assay No. 125), and one of brown zinc blende (assay No. 126), were assayed by Genth, with the following results:

Assays, Ore from the Lemmond's Mine, Union County.

	(125)	(126)
Gold, per ton,	$620.10	$330.72
Silver, "	111.84	20.69
	$731.94	$351.41

A more recent assay of a probably more nearly average sample of ore from the same mine shows:

Assay of Ore, Lemmond's Mine, Union County.

	(127)
Gold, per ton	$8.10
Silver, "	6.80
	$9.90

THE NEW SOUTH MINE is 1½ miles northeast from the Stewart. The work down to 25 feet was satisfactory and profitable. The slates are laminated and thoroughly altered, but at that depth the alterations nearly ceased, and the "blue slates" came in, i. e., drab colored slates with disseminated pyrites. In the miners' parlance the gold "went out," which is merely a practical observation that the gold could not be profitably extracted by the ordinary way of milling or panning.

THE CRUMP MINE is situated 2½ miles southeast of the Stewart in Vance township. It has been worked for a length of 300 yards and was entered by three shafts. The vein matter (slates with some quartz and a little disseminated pyrites) was examined, and the very best and most promising sample of the supposed workable ore assayed with the following result:

Assay, Gold Ore, Crump Mine, Union County.

(128)

Gold, per ton	$6.41
Silver, "	trace
	$6.41

This would indicate very low grade ore for the general run of the mine, but it is noted for its remarkable pockets, and splendid and peculiar nuggets, in which nearly all the gold occurs.

THE BUTTERFIELD MINE is 150 yards to the northwest of the Crump. It has been worked to a depth of 75 feet. The quartz carries copper and iron pyrites.

There are a number of mines in the vicinity of Indian Trail station on the Carolina Central railroad.

They are apparently located in two parallel series about ½ mile apart, comprising in the first or western group the Henry Phifer and Fox Hill mines, and in the second or eastern the Black, Smart, Secrest and Thomas Hemby mines.

The strike of the schists is about N. 30° E., and the dip nearly vertical.

THE HENRY PHIFER MINE is ¼ mile north of Indian Trail. The property comprises a long and narrow tract of 2,000 feet. The veins are stated to have been productive, but no record of the work is now at hand.

THE FOX HILL MINE is one mile northeast of the Henry Phifer. The remnant of the vein could recently be seen in the walls of the shaft, and appeared to be 6 to 10 inches in width, consisting of quartz, brown ore and iron pyrites. It has been sunk upon to a depth of 40 feet. The slates strike nearly north and south where observed, and dip slightly eastward.

THE BLACK MINE is ½ mile nearly east from Indian Trail. There are two veins, or two seams of one and the same vein, only one of which could be examined. It was filled with quartz, and varied from 10 to 30 inches in width, so far as could be seen, although the full width is reported to be 4 feet, with rich seams of mineral matter from ten inches in thickness down to a mere seam. The strike is a little east of north, and the dip slightly eastward. A cross vein is also reported. The mineral matter of the rich seams is of high grade as shown by the following line of assays. It consists of galena, with very little blende, and iron and copper pyrites:

Assays, Gold Ores, Black Mine, Union County.

	Free milling		Sulphurets.		
	(129)	(130)	(131)	(132)	(133)
Gold, per ton	$ 10.33	$ 60.97	$ 98.19	$ 117.82	$ 165.36
Silver, per ton	.45	2.33	3.75	.06	3.81
	$ 10.78	$ 63.30	$101.94	$ 117.88	$ 169.17

Assays of Galenas, Black Mine.

	(134)	(135)
Gold, per ton	$ 42.37	$ 41.34
Silver, per ton	5.56	8.14
	$ 47.93	$ 49.48

The mine workings consist of a shaft 60 feet deep, from the bottom of which a drift extends 30 feet north and 40 feet south.

THE SMART MINE is one mile N. 30° E. from the Black. The country rock is sericite schist, in part highly silicified, which strikes N. 30° to 40° E., and stands nearly vertical. The ore is galena with pyrite in a matrix of quartz; it had been found in some quantity, but the last work in 1888 did not uncover so large a quantity as was expected. The ore body has been proved to a depth of 110 feet, and three levels at 35, 60 and 95 feet respectively have been run, each of which is about 60 feet in length. The

vein is at times 3 to 4 feet thick, but the width of the ore seam is considerably less. Assays show the following values:

Assays, Gold Ores, Smart Mine, Union County.

	(136)	(137)	(138)
Gold, per ton	$ 12.40	$ 13.44	$ 46.51
Silver, per ton	3.94	2.07	5.95
	$ 16.34	$ 15.51	$ 52.46

THE SECREST MINE is ¼ mile northeast of the Smart. The schists are argillaceous to chloritic, striking N. 30° to 35° E., and dipping slightly westward. No reliable information is available respecting its resources. There is another mineral occurrence on the Secrest property, ¼ mile west of the above locality, namely, a northeast and southwest running vein (N. 35° E., with steep westerly dip), with an 8-inch seam of brown ore; and running from it in a westerly direction with steep northerly dip is a quartz vein, carrying galena and chalcopyrite, and varying in width from 2 to 12 inches.

Assays of ores from this mine give the following results:

Assays, Gold Ores, Secrest Mine, Union County.

	(139)	(140)
Gold, per ton	$ 2.07	$ 67.18
Silver, per ton	16.73	5.04
	$ 18.80	$ 72.22

No. 139. From northeast and southwest vein. No. 140. From east and west vein.

About 2 miles north of Indian Trail, on the road from the Smart to the Stewart mine, a heavy debris of a felsitic eruptive rock occurs. It was not found in place.

THE MOORE HILL, FOLGER HILL, DAVIS, PHIFER, LEWIS, HEMBY GROUP OF MINES.

About 2 miles south of Indian Trail is situated a group of mines, comprising the Moore Hill, Folger Hill, Davis, Phifer, Lewis, Hemby and Harkness.[1] The relative position of these mines is shown in the accompanying sketch map (Fig. 6).

[1]Geological Report of the Midland Counties of North Carolina, 1856. E. Emmons. p. 167.

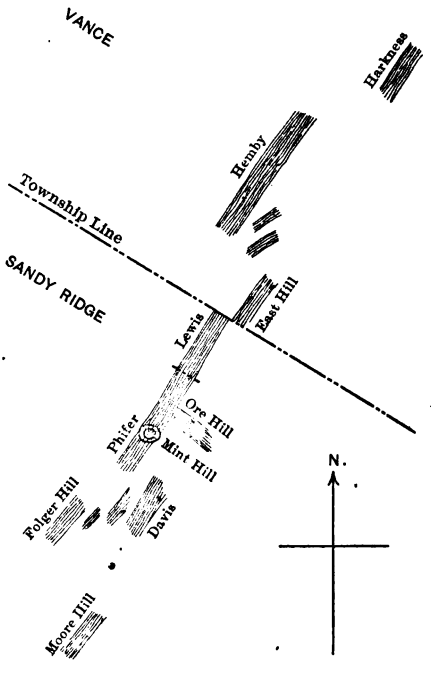


FIG. 6. Sketch map showing relative locations of the Davis, Phifer, Lewis, Hemby, etc., mines, Union county.
Scale of longitudinal distances: 3 inches—1 mile. The transverse distances are slightly exaggerated.

This zone of auriferous schists is 3 miles in length and not much less than one-half mile in width, some parts of which are capable of being operated, and some parts not, but none absolutely barren.

Occasional pits both to the east and west of the line of work indicate that the zone is in reality much wider, but not commercially workable, so far as yet prospected. Beyond the Hemby and Harkness, immediately to the northeast, little has been found, and the location of the "Big Survey" lands have prevented prospecting to the southwest.

For a distance of nearly two miles there is an almost unbroken series of pits and shallow shafts. This vast number of diggings is the result of petty leases (which will also account in great part for the shallowness of the pits), and incidentally bears witness to the value of the deposits, which have been very rich, especially on the Phifer tract, where on Mint Hill an open cut, 100 feet in diameter and 50 feet deep, was worked out. Petty work is constantly going on along the whole line, but none of the mines are being systematically operated.

The country rock is an argillaceous schist, which strikes N. 20° to 45° E., and stands nearly vertical, dipping slightly easterly in some places and westerly in others, the latter prevailing. These schists vary from soft to very highly silicified types. They are impregnated with finely divided iron pyrites up to 1 or 2 per cent.; small lenses of pyrite and calcite also occur; and quartz stringers are frequent.

The occurrence of diabasitic dikes has been noticed at the Phifer, Hemby and Harkness mines.

The gold is not uniformly diffused, but is carried mostly in narrow, parallel seams, rarely more than an inch or two thick, and sometimes not thicker than a knife blade; the seams are quite porous and discolored with peroxide of iron and oxide of manganese above the water level.

The ore bodies as a whole are 1 to 6 feet wide, in which these seams occur abundantly and closely together. And the barren ground is that portion in which these seams are of infrequent occurrence.

A glance at the sketch map (Fig. 6) shows that these workable belts are frequently not continuous in length. A new belt, lying parallel to the first may appear; or, after a short unproductive interval, the same belt may reappear.

The softness of the schists above the water line permits of easy and cheap work to this depth (40 to 50 feet); hence the innumerable shallow pits; but below this line the costly and more difficult nature of the work and the occurrence of sulphurets renders mining and milling more difficult, so that the ore bodies below this depth are still largely intact.

The Moore Hill tract has been worked 100 feet in length, and at the most 70 feet in depth.

The Davis has been worked fully 500 feet in length, and to a maximum depth of 150 feet in the "Road" shaft.

Folger Hill has been worked some 300 to 400 feet in length. Random samples of rejected ore from the surface gave:

Assay, Rejected Gold Ore, Folger Hill, Union County.

	(141)
Gold, per ton	$4.13
Silver, per ton	.22
Total	$4.35

The Phifer (or Price) Mine is situated in a belt at least 100 feet west of the Davis, and has been worked for a length of 400 feet and to a depth of 100 feet. Very rich stringers have been found here. Mint Hill is a fine illustration, for so abundant and rich were the stringers that the whole material for 100 feet in each direction and 80 feet in depth was taken out and milled.

At Ore Hill a system of cross fissures (strike S. 33° E.; dip 57° N. E.) occurs, which has been worked to a depth of 80 feet.

The Lewis Mine has been worked nearly 1,000 feet in length and to a depth, in places, of 80 feet.

The fineness of the gold at the above described mines is of low grade. The Davis gold is sometimes not worth more than 35 cents per dwt., and little of the gold will exceed 75 cents. Moreover, the occurrence of stringers near each other with gold of quite varying values points to dissimilar conditions of original deposition. Galena in sparing quantity occurs at times.

East Hill, lying to the northeast of the Lewis, has apparently a position to the east of the extension of the Lewis belt. It carries a great deal of heavy quartz.

The Hemby Mine appears to lie slightly to the west of the Lewis and Phifer lead. The shallow workings extend for a distance of 1,200 to 1,500 feet along the strike. There are two shafts here over 100 feet in depth. The old mine dumps show much solid, glassy quartz. Siderite occurs as a gangue mineral.

Several non-parallel bodies exist on the property. Samples from some recently exposed, but ordinary looking seams of ore assayed:

Assays, Gold Ores, Hemby Mine, Union County.

	(142)	(143)
Gold, per ton	$3.10	$15.71
Silver, per ton	.21	.86
Total	$3.31	$16.57

The Harkness Mine is 1½ miles northeast of East Hill, and from its position and the nature of the ore (heavy quartz) it appears to be a continuation of the latter. It has been worked for a length of 300 feet, and to a reported depth of 120 feet. The strike is N. 20°–25° E. The ores, so far as they could be examined, are very quartzose, containing coarse gold of relatively high grade.

THE BONNIE BELLE AND HOWIE GROUP.

A group of mines of some importance, consisting of the Bonnie Belle and Howie, is situated some 6 miles south of the Davis, Phifer, Lewis, etc., group, and about eight miles west of Monroe.

THE BONNIE BELLE (or Washington) MINE is 1½ miles north of Potter's Station, on the Georgia, Carolina and Northern R. R.

The country rock is argillaceous schist, varying in degree of hardness from soft to highly silicified. The strike is N. 55° E., and the dip steeply westward. At one point an obscure outcrop of mica gneiss was observed. The schists show banding both with and across the schistcsity, pointing to their sedimentary origin.

A diabasitic dike intersects the country nearly at right angles; it is reported to be 10 feet in thickness, dipping 40° to 45° S. W. The schists are impregnated with finely divided sulphurets, chiefly pyrite and some little chalcopyrite. Small specks of free gold occur as coatings on the major cleavage planes. Very small quartz veinlets intersect the schists at various angles. The general width of the ore bearing belt is stated to be 14 feet, and it has been proven over a distance of at least ¼ mile along the strike, besides being traced much farther by pan tests. There are also indications of other parallel ore bodies but these have not yet been prospected. When visited, in the fall of 1894, the mine was being operated experimentally, and the ore treated in a combination Chilian and four dragmills, which discharged on amalgamated copper plates, and thence to a Gilpin county bumping table for concentration. The capacity of the mill was 10 tons per 24 hours.

The shaft from which the ore was raised is located near the mill. If was about 20 feet deep at the time when visited. The thickness of the ore body in this shaft was from 5 to 8 feet, the richer portion lying in the 2 feet adjoining the hanging wall. Samples of the ore were taken from the crusher at the mill, also of the concentrates and tailings, and the assays by Dr. Chas. Baskerville show:

Assays, Bonnie Bell Mine, Union County.

	Ore. (144)	Concentrates. (145)	Tailings. (146)
Gold, per ton	$4.13	$20.67	trace
Silver, "	1.42	1.94	$ 1.03
	$5.55	$22.61	$1.03

THE HOWIE MINE[1] is situated about 1 mile south of west from

[1] Geological Report of the Midland Counties of North Carolina. 1856. E. Emmons; p. 133.

the Bonnie Belle. The country rock is a dark colored argillaceous slate usually highly silicified. The strike is N. 55° E., with a very steep dip to the northwest.

The ore bearing formation is said to extend over a width of 400 feet, and fully a mile in length. Within this belt there are perhaps as many as 8 so called "veins" or ore seams, varying from 18 inches to 16 feet in width. It is difficult, however, to say where "vein" matter is not found, as the rocks of the entire region are gold bearing. The mine stuff rarely shows by its external appearance what material is and what is not rich enough for remunerative work, and this is determined by constant tests.

Pyrite to the extent of about one (1) per cent. is widely disseminated, and occurs somewhat more abundantly on the cleavage faces and joints of the slates. The slates are penetrated by numerous seams of quartz, which generally have the effect of enriching the ore body. Free gold occurs as fine films on the cleavage and joint planes of the slates.

Cross-fissures occur in the mine, filled with a "reibungs-breccia" of slate fragments cemented by pure white crystalline calcite. Small calcite veinlets penetrate the slates in various directions.

Diabase dikes are of frequent occurrence; they strike in a northwest direction across the slates. It is stated that the ore is richer in the vicinity of these dikes. The mine is inaccessible, but as the rock is extremely hard most of the shafts, although filled with water, are still intact. The deepest shaft was the Cureton, 300 feet deep.

The ore, as might be supposed, runs through a wide range of values. The former superintendent, Mr. I. Bates, reported that the average ore will yield in the mill about $13.00 per ton. The average of 12 assays of the "soft" ore (above water level) by Prof. Spears, of New York, gave for the gold and silver contents a value of $14.60 per ton; and the rubbish piles were shown by him to carry $3.25 per ton. An examination of various tailing dumps showed that a surprising amount of gold was lost in the mill work.

As already mentioned on p 36, the Monroe slates are intersected by quartz fissure veins. These veins are in instances auriferous, and at several points a short distance west of Monroe, prospects of gold have been discovered and superficial explorations made, but presumably without much success, as they were never pursued to any extent and are now abandoned.

ANSON COUNTY.

THE HAMILTON (BAILEY) MINE is situated 2 miles southeast of Wadesboro. There are two quartz veins of which the westerly was formerly worked to a depth of 100 feet; it is stated to be 2½ to 4 feet in thickness. Assays have shown variable values from $4.00 to $30.00 per ton.

The Jesse Cox mine is in the same vicinity.

CHAPTER V.

THE CAROLINA IGNEOUS BELT AND ITS GOLD DEPOSITS.

GENERAL DESCRIPTION OF THE BELT.

The Carolina Slate Belt is bounded on the west by an area of massive, igneous, plutonic rocks, extending across the State in a southwesterly direction, and having a width of 15 to 30 miles. This is the Carolina Igneous Belt of gold bearing rocks. It includes the greater portion of the counties of Guilford, Davidson, Rowan, Cabarrus, and practically the whole of Mecklenburg. The area of the auriferous portion, however, is scarcely more than 1,000 square miles. At the northeast, in Guilford county, the mines occur near the southeast edge of the belt, and near the schists; this relative position they hold as far south as Rowan county, where they begin to appear at a considerably greater distance from this border, and finally in Mecklenburg county, near the southern boundary of the State, they stretch nearly across the entire area of igneous rocks from east to west. It may be said, with almost absolute accuracy, that the mines are on the east side of the main line of the Southern Railroad to a point little further south than Concord, where the mineral belt crosses the railroad abruptly and spreads to the westward.

GEOLOGIC CHARACTERISTICS.

The rocks are, so far as macroscopic determinations go, granitic, dioritic, gabbroitic, and diabasic eruptives, sometimes passing into each other by gradual transition phases. Schistose or gneissic structure is developed in places, as in the vicinity of Lexington, Davidson county, where the strike is N. 20° E., and the dip, as a rule steeply westward.

From the nature of the contact, it appears that the age of this igneous mass is younger than the slates and schists of the Carolina Slate Belt on the east.

Diabasic and granitic dikes again intersect the main igneous mass, and are therefore still later intrusions. These dikes are

sometimes indistinctly schistose in the same direction as the schistosity of the enclosing rock, where such is developed, which would indicate that they were intruded before the force producing schistose structure was active. Furthermore they are often finer grained towards the edges than in the centre. In places they split, sending off cross-dikes. But as a rule they are more regular in outline, and in width may vary from a few inches to many feet.

The auriferous quartz veins, which are found in these rocks, are the fillings of fissures. These fissures, particularly where they occur within a more or less homogeneous mass, are quite regular in outline, as at the Reed, Phœnix and Reimer mines. On the other hand, in some instances, they appear as pocketed or lenticular bodies, as at the Surface Hill mine, along the contact of a diabase dike with the granite. In still other places the quartz veins are confined to the diabase, as at the Phœnix mine.

If this diabase is in itself the filling of a dike fissure the age of the gold veins must be subsequent to the dike formation, a fact which does not agree with that found to exist in the Carolina Slate Belt, where the diabase dikes intersect the ore bodies. And it would thus appear that there were two eras of dike formations. However, the true relations of the rocks could not actually be determined at the Phœnix, as the mine was inaccessible, and the rocks could not even be seen in place. In fact, the diabase dikes in North Carolina might even be referred to three ages, including those which are found in the Jura-Trias, and which must hence be post Jura-Triassic. These are, however, but suggestions which are subject to modification on further research. They simply present a line for investigation.

THE ORE DEPOSITS OF THE CAROLINA IGNEOUS BELT.

It seems clear that the genesis of the gold ores in these igneous rocks must be ascribed to the ascension of mineralized waters.

These gold ores are often cupriferous; they rarely contain any notable amount of lead, zinc, or nickel; the silver present is usually alloyed with the gold; arsenic and antimony are not com-

mon, and the ores are refractory only as the sulphurets make them so.

The chief filling of the fissures is quartz, carrying the auriferous sulphurets. Frequently a finely laminated argillaceous or chloritic slate is noticed in the filling, parallel to the walls of the veins; it is sometimes within the quartz itself but, but generally nearer the walls, shading gradually into the country. The presence of these slates in a vein, where there is at best but slight development of schistosity in the enclosing country rock, is an interesting phenomenon. In depth the slaty structure does not exist, or becomes obscured.

In many mines there is what is called a back and a front vein (occasionally a middle vein also), but all evidence goes to show that they are but parts of the same vein.

The quartz frequently shows a banded structure, especially near the walls; and there is often a parallelism in the occurrence of the sulphurets.

The frequent cupriferous nature of the ore in this belt has been alluded to. The copper ores, unless they were of such exceptional richness as to bear costly land transportation, had no market, and the time came when the price of copper fell so low as to preclude the working of these ores for copper alone. The low grade copper ores, which (in sections favored with cheap transportation, or near commercial centres) could be easily beneficiated by concentration, were here valueless; and as it was found by experience that the presence of copper greatly hindered the amalgamation of the gold ores, for which these mines were in every case originally operated, the presence of any considerable amount of copper was the signal for abandoning the mine. It is also quite true that copper pyrite, as a rule, does not carry as much gold as iron pyrite.

It is not probable that the ores of copper are likely to be of importance for the exclusive production of that metal in the present condition of the copper market; but in a smelting treatment of the gold ores of this section (particularly the complex sulphurets), the command of a large supply of auriferous copper

ores is almost essential to the prosperity of many of the mines of central North Carolina.

THE MINES IN THE CAROLINA IGNEOUS BELT.

MINES IN GUILFORD COUNTY.

The mines of this county lie to the south and southwest of Greensboro. They carry highly cupriferous ores, and have been worked both for gold and copper. Emmons described these mines in 1856,[1] and a brief condensation, with some rearrangements and additions, is made from his report, as a matter of convenience to those who have no opportunity to consult the same.

THE HODGES (OR HODGINS) HILL MINE is situated 6 miles southeast from Greensboro, and lies near the western edge of the granite. The vein is stated to strike a little west of north and to dip to the southwest, 400 feet on the slope making hardly more than 100 feet in vertical depth. It is from 6 inches to 12 feet in width. Pits have been sunk along the outcrop for a distance of 800 to 900 feet. The gold is distributed unequally through quartz and chalcopyrite. Other gangue minerals are pyrites, siderite, manganese oxide and limonite. The alteration copper minerals are malachite and red oxide. Various assays show the following:

Assays, Ores from Hodges Hill Mine, Guilford County.

	(147)	(148)	(149)	(150)	(151)
Gold, per ton	$ 1.03	$ 2.07	$ 11.36	$ 22.74	$ 45.47
Silver, per ton	trace	trace	trace	trace	.58
	$ 1.03	$ 2.07	$. 11.36	$ 22.74	$ 46.05

Samples for assays Nos. 147 and 148 are from the poorest brown ore to be found on dump Sample for assay 149 was from the best appearing oxidized, cellular siderite from dump. Sample for assay 150 was from the screened and partly concentrated ore. Sample for assay 151 was taken from the most prominent iron pyrites obtainable from the dump.

THE FISHER HILL AND MILLIS HILL MINES are 5 to 6 miles slightly west of south from Greensboro, and two miles west of the Hodges Hill. The mining tract comprises 900 acres. Fifteen veins are reported on the property. One system runs approximately north and south, and a second nearly northeast and southwest. The main work was done at three points; Fisher Hill; Millis Hill, nearly 150 rods south; and the Puckett vein, towards the southern extremity of the property. The dip of the two Hill veins is very

[1]Geological Report of the Midland Counties of N. C., 1856. E. Emmons. pp. 170-175; 196-204.

flat, from 15° to 20°. The Fisher Hill vein carries a little copper; Millis Hill a somewhat larger quantity; and the Puckett a considerable amount, with a heavy percentage of iron pyrite.

The aggregate length of the veins on this property is perhaps not less than 8 or 10 miles, though not everywhere capable of being worked under existing conditions. The vein which was most extensively worked is traceable for nearly a mile, and has been successfully operated at several points. The ore body varies from 4 inches to 10 feet in thickness, and carries relatively high grade milling material. Four levels, aggregating nearly 200 feet, have been run. The milling plant consists of 10 stamps, and was in operation in 1886 and 1887.

The Twin Mine is situated 6 miles southwest from Greensboro. It derives its name from the fact that two parallel veins are exposed in one tunnel. These veins have a strike of N. 40° E., with a southeasterly dip. The slate between the veins is 4 feet thick, and the veins about 18 inches, consisting of quartz carrying chalcopyrite.

The Raleigh vein is a continuation of the Twin.

The North Carolina (or Fentress) Mine is situated from 9 to 10 miles south of Greensboro, and near the eastern edge of the igneous belt. The old mine dumps bear witness to the size of the vein, as well as to its length, for it has been traced some 3 miles along the outcrop; though the part which was actively worked does not exceed ½ mile in length. It has been entered by 3 deep shafts, and by a great number of shallow shafts and pits. The strike is variable from N. 25° E. to more easterly; the dip is westerly from 38° to 60°. The main, or Engine shaft, is 400 feet deep, partly vertical (possibly 330 feet), and partly on the underlay. Four levels have been run from 300 to 500 feet in length.

In the Worth shaft, at the extreme southwesterly end of the vein, the ore body is 3 to 4 feet thick at the depth of 40 feet; at the extreme northeasterly end it is 3 feet thick at a depth of 55 feet; while at the Colby shaft it is 1 foot thick at a depth of 40 feet. At 310 feet the fissure is from 7 to 13 feet wide between the walls. There is, however, no improvement in the

vein where it is expanded, and it carries no more copper than when 7 to 8 feet thick. The copper sulphurets shift in position, lying upon the footwall for 30 to 40 feet, then suddenly curving upwards and following the hanging wall for a distance of 20 to 30 feet; or without a curve, they suddenly leave one wall and take to the other. Occasionally they occur in nests or solid masses 18 to 20 inches long by 7 to 8 inches thick. The vein stone is quartz and carbonate of iron.

In 1855-56, when the mine was last worked on any considerable scale, it had a high degree of prosperity, and shipments of copper ore, for which it was then exclusively worked, amounted to 1,400 or 1,500 tons, ranging from 14 to 23 per cent. copper. The shoot then worked lay upon the footwall side, just above the 310 foot level, and had a maximum width of 34 inches. The following assays represent samples taken from the old mine dump:

Assays, Ores from the North Carolina (or Fentress) Mine, Guilford County

	(152)	(153)
Gold, per ton	$ 0.62	$ 6.20
Silver, per ton	———	.77
	$ 0.62	$ 6.97

No. 152. Carbonate of iron, which appears to contain practically no gold, except when pyrites are casually intermixed.
No. 153. Iron pyrite, with a trifling per cent. of copper.

THE GARDNER HILL MINE is 2 to 3 miles a little to the north of east from Jamestown. Comparatively little work has been done here since Prof. Emmons examined the mine in 1856, and the following extract is taken from his report[1]:

"It is a true vein, whose direction is N. 20° E., with a westerly dip. * * * * The gangue is quartz intermixed with brown ore, which lies against the footwall, and is from 6 to 12 inches thick. * * * The lode is bounded by slate or killas; but the adjacent granite on the lower or footwall is extremely tough and hard, while that on the upper side is soft. The arrangement of the vein stone is shown in Fig. 8. *a. a.* the granite enclosing

[1] Geological Report of the Midland counties of North Carolina, 1856, pp. 174-176.

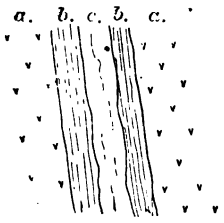


Fig. 8. Showing structure of the vein fissure at the Gardner Hill mine.

the vein fissure; *b. b.* killas or slate; *c.* vein. The vein fissure is rarely more than 3 feet wide near the top, and in a part of the lode at the depth of 80 feet it is only 8 inches, where the ore is poor. The vein stone is quartz as is commonly the case in granite, but upon each side it is bounded by slate, which of course fills in part the fissure. * * * * The gold bearing oxide is derived from the copper and iron pyrites. It seems, therefore, that the gold attaches itself, as usual, to the sulphurets. * * * * The Gardner mine, at the depth of 110 feet, yields, under careful management, about one dollar per bushel[1], the poorest about fifty cents. The ore contains a handsome quantity of rich sulphuret of iron and copper; it yields about 30 per cent. of copper; it is not largely intermixed with iron pyrites at any part of the vein. There are probably three veins upon the Gardner property, but I have been unable to determine their relations."

The following facts have been elicited by the present survey:

The vein has been worked for a length of 5,000 feet along its course, from the Creek shaft on the northeast to the White Oak shaft on the southwest, but the main work has been confined rather to the southerly part of the property.

The following shafts have been sunk, and in the order named:

The Creek shaft, 110 feet deep, on the underlay. The ore body was 6 to 8 inches wide, consisting of iron and copper pyrites in quartz.

The Underlay shaft, 600 feet southwest, is 175 feet deep on the incline.

The Old Engine shaft, some 400 feet from the south end of the property is 175 feet deep, vertical.

The New Engine shaft, still farther southwest, is 258 feet in depth, vertical. No. 2 shaft, 250 feet southwest of the above, is 110 feet deep, vertical.

The White Oak shaft at the southern boundary of the property, is 150 feet deep, vertical.

[1] Twenty bushels to the ton, approximately.

There are four levels at 60, 100, 150 and 228 feet. They average 500 feet in length, and have been driven in both directions from the shafts, with the exception that no south level was driven from the White Oak shaft. The mine is pretty well stoped out from the water level (60 feet) to the bottom of the respective shafts. Down to the water level the product was free-milling brown ore; from the water level on it runs into copper sulphurets.

When copper ore was encountered in quantity little further effort was made to extract the gold; shipping ores of copper were exclusively sought after, and for many years a very high degree of prosperity was enjoyed; it is stated that for a long period 40 tons of yellow copper ore were shipped weekly, averaging from 20 to 25 per cent. copper. The width of the veins at times was fully 20 feet.

It has been stated that there are three veins on the property. A few feet back of the Main vein is the Worth vein, which is supposed to have been worked out, from the surface down. It is claimed to have been very productive, and to have enriched the owners and lessees, but no records are in existence.

Another small vein (the Goshen) lies some 200 to 300 feet behind the Main vein, but the Survey is unable to make any further statements respecting it.

The vein matter shows everywhere heavy quartz with much brown ore, but some of this latter is evidently derived from the alteration of carbonate of iron, which is abundant.

The copper sulphurets were separated very clean by cobbing and dressing, and very few copper minerals can now be seen, but quartz, carrying iron pyrite in small quantity is abundant in every dump.

Some tentative assays show from $3 to $10 per ton in the ore, which would be sufficiently auriferous to allow profitable milling and concentrating. It is estimated that there are 25,000 tons of ore on the dump at present, which can be handled at a merely nominal expense.

THE NORTH STATE (OR MCCULLOUGH) MINE is situated 2 miles west of south from Jamestown. Its southerly extension is the

Lindsay, and its northern the Jacks Hill; then the lode passes on to the unprospected Whitehead property for half a mile or so; and to the north of this is the Aberdeen mine. The entire series forms a stretch nearly 3 miles in length. For a considerable part of this distance the dumps show an immense accumulation of heavy blocks of quartz, which bear witness to the great size of the veins.

The Deep River mine is two miles south of the Lindsay.

The following, in reference to the North State mine, is from Emmons:[1]

"The vein fissure pursues a northeast course, but is curved in the middle. It dips S. 80° E., and at one place S. E. The vein is composed of a column of brown ore resting on the footwall, which extends from the outcrop to 130 feet in depth. Upon this rests the disintegrated ore, containing 8 inches of beautiful copper pyrites, and then against the hanging wall, quartz rather poor in gold and frequently 8 feet thick. The vein at the surface is about 2 feet wide; at 60 feet it is 4; at 90 feet it is 10; and at 130 feet it is 24½ feet wide. It dips at an angle of 45 degrees. At the 130 foot level it swells out into a rather lenticular form. Here the ore is concretionary; on the footwall the brown ore is 6 inches thick only, then copper pyrites, then a belt of brown ore containg nodules or concretions of pyrite more or less changed, the middle of which is rich in gold. Upon the hanging wall is the principal mass of porous quartz, which is generally poor. The brown ore is soft, and easily crushed. It is intermixed with fine quartz and spongy masses of it, which are rich in gold. * * * Towards the north is Jacks Hill; a shaft sunk in the top of this hill cuts the vein at a depth of seventy-seven feet, where it is seventeen feet thick. * * * The copper is the purest sulphuret, yielding by analysis thirty per cent. of copper. * * * The McCulloch vein carries its gold in combination with the sulphurets."

Later information shows that the Rodman shaft was sunk 200 feet vertical, and 50 feet on the underlay; the Eudy shaft is 240

[1] Geological Report of the Midland Counties of North Carolina, 1856. p. 170.

feet vertical and 120 feet on the underlay; the Peters and the Long shafts are of comparatively moderate depth. The last work was done at the depth of 325 feet, where the vein varied from 4 to 8 feet in width. In 1883 a ten stamp mill was erected, and during that and the following year materials from the old mine dumps were treated. In 1885 the mine was abandoned.

At the LINDSAY MINE (see also page 115) the more important work was done at the South shaft No. 2, which was 100 feet in depth; twenty-two feet behind the main vein in this shaft a second vein was discovered, but never stoped. Subsequently there were sunk the South shaft No. 1, 90 feet deep; the Engine shaft, 150 feet vertical and 60 feet on the incline; and the Willow shaft, 110 feet deep.

It is not feasible to estimate the amount of ore on the dumps of this stretch of 2 miles or more, still less can any reliable statement of their value be given. Some recent assays indicate a very wide range from $3.00 upwards. A series of 87 assays taken from all parts and from all classes of ore at the Lindsay mine ranged from $4 to $100 per ton.

The Beason, Harland, Beard, Vickery and Lauder, Eudy, and Ball mines are in the immediate vicinity of Jamestown, but no trustworthy information of importance has been secured respecting these.

MINES IN DAVIDSON COUNTY.

THE LALOR (OR ALLEN) MINE is situated 2 miles southeast from Thomasville. There are 3 shafts, the deepest of which is 165 feet on the underlay, corresponding to about 140 feet vertical. The vein is reported of good width and carries a fair proportion of iron and copper pyrites. The percentage of copper sulphurets is large enough to give, when concentrated, a product very desirable for matte smelting. The mine was operated in 1882 by the Campbell Mining and Reduction Company of New York. The mill contained 10 stamps and concentrating apparatus. A roasting furnace on a novel plan was erected to desulphurize the ores preparatory to smelting. By 1886 the work had practically ceased.

The Loftin Mine is one and a half miles southeast of Thomasville. Its vein stuff is quite similar to that of the Lalor mine.

The Eureka Mine is one-half mile west of the Lalor. It is penetrated to a depth of 125 feet. The width and character of the vein and the nature of the ore are nearly the same as at the Lalor mine. Assays show the ore to vary from $8.00 to $25.00 per ton.

The Black Mine is adjacent to the Eureka.

MINES IN ROWAN COUNTY.[1]

A group of mines is found to the southwest of Salisbury, from 2 to 9 miles distant, and 1 to 3 miles east of the Southern R. R. Among the principal ones are the Hartman, Yadkin, Negus, Harrison, Hill, Southern Belle, Goodman, Randleman, and Roseman.

The workings in these mines have been comparatively shallow, 160 feet being the deepest so far as records go. The width of the ore bodies and their values are not matters of record, and nothing can be said of them here with exactness.

Another group of mines, including the New Discovery, Dunns Mt., Reimer and Bullion, is situated from 3 to 7 miles east and southeast of Salisbury.

The New Discovery Mine is 3 miles east of Salisbury. The greatest depth to which it has been worked is 100 feet. In 1883 a plant for treating the ore by the Designolle process was erected, but the ore was found deficient in quantity and difficult to treat, and all operations ceased towards the close of the year.

The Dunns Mt. Mine is situated 3½ miles east of Salisbury, and about ⅓ mile northwest of Dunns Mt. It has practically been idle for the past 10 years. The old mine dumps show large masses of a dark grey dioritic rock, impregnated with pyrites; also a fine-grained schistose and a micaceous phase of the same; also a light pink gneissoid granite. The actual relations of these rocks unfortunately could not be ascertained, but it seems probable that the country rock is the gneissoid granite of the Dunns Mt.

[1]For description of mines in Rowan county in the slate belt, see pp. 85-91.

type, which has been penetrated by a dioritic boss or dike, presenting various phases, and carrying the auriferous quartz veins.

It is stated that there are 3 veins, one northeast and southwest, one northwest and southeast, and one nearly north and south (the Office vein). The first of these was worked to a depth of 190 feet, averaging about 4 feet in width. It was largely filled with slate and quartz, and carried only a moderate proportion of pyrite with a trace of chalcopyrite. The Office vein was worked to a vertical depth of about 140 feet. The ores were oxidized nearly to the lowest level, and contained but a small amount of sulphurets.

THE REIMER MINE[1] is situated 6 miles southeast of Salisbury, and about 1 mile east of the Gold Hill R. R., on the waters of the Yadkin river. The accompanying cut (fig. 9) illustrates a vertical section of the mine, on the strike of the vein:

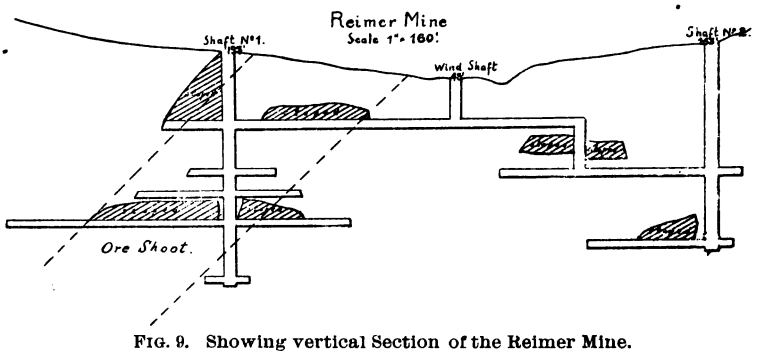


FIG. 9. Showing vertical Section of the Reimer Mine.

The mine is opened by 3 vertical shafts, respectively 193, 43 and 165 feet in depth. The vein-stone is quartz, carrying about 10 per cent of sulphurets (mostly pyrite with very little chalcopyrite), as reported by the superintendent. In width the fissure is stated to average about 3½ feet, varying from 1 to 9 feet. The quartz shows a tendency towards banded structure parallel to the walls, which are smooth and accompanied by a clay gouge.

The strike of the vein is approximately east and west (W. 15° N.), but in the west end of the mine the course has been deflected, by a horse, to about W. 40° N. The dip is practically vertical.

[1]Geological Report of the Midland Counties of North Carolina, 1856. E. Emmons. p. 181.

The following sections (fig. 10) are introduced here in order to illustrate the character and relation of the wall rocks:

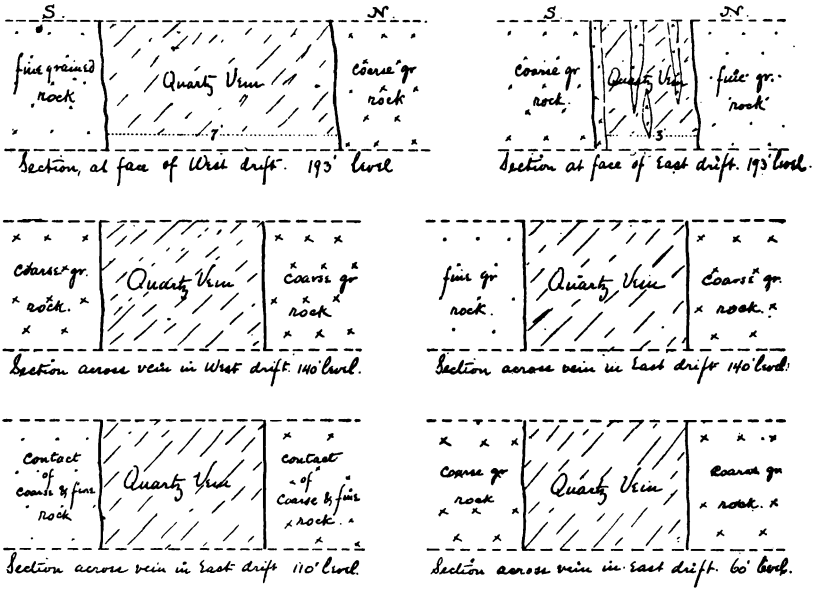


Fig. 10. Cross sections on the Reimer vein in Shaft No. 1, showing character of the wall rocks.

The coarse grained rock is provisionally called quartz diorite, and the fine grained rock is possibly a phase of the same. The alternate occurrence of these two varieties on opposite walls, and even in contact on the same wall (110 foot level) suggests either an intrusive dike of the fine grained rock, or merely a different magmatic phase of the same general igneous mass. The intrusive theory seems rather untenable from the fact that this rock never cuts off the quartz vein.

The last work at the Reimer was done in the summer of 1895, in the lower level of shaft No. 1. In the west drift at a short distance from the shaft a "horse" from the hanging wall had narrowed the vein to 12 inches. The reduction plant at the mine consists of a 20 stamp mill, 4 belt concentrators, roasting furnace, and a one-barrel chlorination house after the Thies pattern. Assays of the ore show as much as $24.00 to the ton, but it is not believed that it can average much over $4.00 or $5.00.

The concentrates are stated to be worth $30 to $40 per ton. About $\frac{1}{5}$ of the gold extracted is saved by amalgamation in the mill.

THE BULLION MINE is situated about one half mile east of the Reimer. The outcrop shows that the vein is of good width, but for some unknown reason it has never been much worked. At the depth of 90 feet a level was driven 200 feet in length, and a 7 foot vein reported. The last work is supposed to have been done in 1881. Some assays of these ores show:

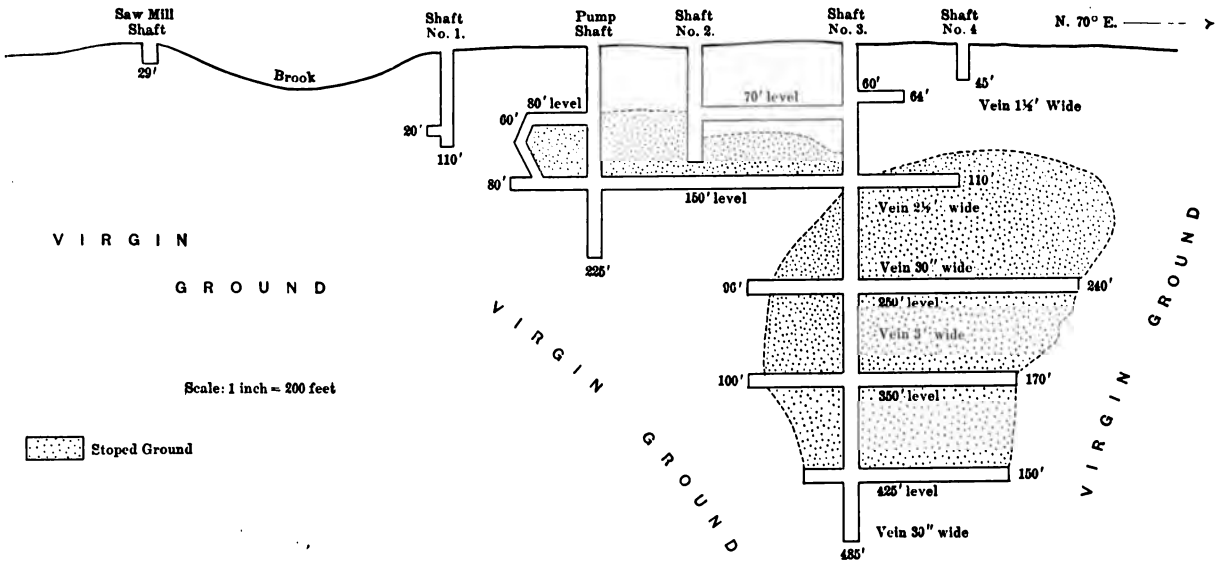
Assays, Ores from the Bullion Mine, Rowan County.

	(154)	(155)	(156)	(157)
Gold, per ton	$6.20	$9.32	$10.34	$15.51
Silver, "	1.30	1 55	1.88	1.03
	$7.50	$10.87	$12.22	$16.54

Another group of mines is situated 8 to 10 miles southeast of Salisbury, near the Stokes Ferry road. Among these may be named the Gold Knob, Dutch Creek, Atlas, and Bame. The more easterly of these lie about one mile west of the contact between the granite and the schist. None of the mines have been worked for the past 10 years.

THE GOLD KNOB MINE is 9 miles southeast of Salisbury. Three veins have been worked: the Haynes, the Gold Knob, and Holtshauser. The Gold Knob is in places 20 feet in width. The quartz carries iron and copper sulphurets, and is, as a rule, of low grade, though chimnies of high grade ore may be expected.

THE DUTCH CREEK MINE is 10 miles southeast of Salisbury, just to the southeast of Dutch Second creek. The property contains a net work of veins, among which the more prominent and chiefly developed ones are the Katie, Hill, Tip-top, and Spring. The Hill and Tip-top have 2 shafts down to water level, below which line the ores are sulphuretted and refractory to mill treatment. Several shafts on the Spring vein also expose sulphurets (pyrite with some chalcopyrite) at water level. Two shafts were sunk on the Katie vein with like results. Several of the other veins are high in copper sulphurets. Most of these veins run in a general northeast and southwest direction, but some seem to have a more northerly course, intersecting the normal running veins.



PHŒNIX VEIN—PHŒNIX MINE.

A longitudinal section from surveys by A. Thies. Shaft No. 2 is vertical; all other shafts are inclined at an angle of about 80 degrees.

Statements made by Mr. Wm. H. Orchard, superintendent of the mine prior to Mr. Thies' connection with it, indicate that the following areas may have been stoped also:—(1) The entire area between Shafts No. 1 and No. 3, above the 150 foot level; (2) between Shafts Nos. 3 and 4, above the 60 foot level; (3) between the Pump Shaft and Shaft No. 3, for a short distance below the 150 foot level; (4) for a short distance below the surface, between the Saw Mill Shaft and Shaft No. 1. But these old workings were inaccessible at the time Mr. Thies' work was done.

THE ATLAS AND BAME MINES are supposed to be in the southwest continuation of the Dutch Creek veins. The strike of the veins is N. 35° to 40° E., with nearly vertical dip. Some of them are wide, but the ore, as a rule, is rather low in grade, at least so far as the free milling qualities go.

CABARRUS COUNTY.

The Joel Reed and Montgomery mines are situated in close proximity to Concord, the county seat, but not enough is known of these to justify any description.

A group of some importance, comprising the Phœnix, Tucker and Quaker City mines, is situated 6 to 8 miles southeast of Concord.

THE PHŒNIX MINE[1] is 7 miles south of east of Concord. It was last worked in 1889 under the management of Mr. A. Thies, E. M., now of the Haile mine, S. C., who treated the ores successfully by the chlorination process. It was inaccessible when visited in 1894. The country rocks are schists, but as the auriferous veins occur in diabase which traverses the schists, the mine is included here in the igneous belt. The old dumps show both soft and silicified types of the schist, besides large masses of diabase of two types: (1) a fine grained, massive; (2) a porphyritic phase of the first. The following notes are based upon data which have been kindly furnished by Mr. Thies:

There are three parallel veins about 200 and 1,000 feet apart. The main (Phœnix) vein, lying on the northwest, strikes N. 70° E., and dips 80° N. W. It has been traced for 2,100 feet on the surface and varies from 12 inches to 3 feet in thickness. Mr. Thies' work was confined to the 300 foot shoot in this vein. It pitches to the northeast, and is opened by shaft No. 3, sunk 485 feet on the dip of the vein. Stoping has been done from the 100 to the 425 foot level. Plate No. IX shows a longitudinal vertical section of the workings. The filling of the fissure is quartz, carrying from 3 to 60 per cent. of sulphurets (pyrite, chalcopyrite and traces of galena). The other gangue minerals are barite, with

[1]Geological Report of the Midland Counties of North Carolina. E. Emmons, 1856. p. 178.

some calcite and siderite. Free gold is found in the barite and calcite. In the bottom of the 485 foot shaft the vein averaged 30 inches in width, but the "pay-streak," lying on the hanging, is only from 2 to 3 inches thick. It is believed that if the vein were drifted on here, in a southwest direction, the large ore shoot formerly mined from the pump shaft, would again be reached.

The Pump shaft, 213 feet deep, is situated 300 feet southwest from No. 3. The so-called "Big Sulphur" shoot was worked here in former years from the 180 foot level to the surface. The ore in the bottom of the shaft is 14 inches thick and shows free gold.

The Phœnix ores were treated by mill amalgamation and subsequent chlorination of the roasted concentrates. A Mears chlorination plant was erected in 1880, and was later on developed by Mr. Thies into what is now generally known as the "Thies process."

The ores were cobbed and sorted, the heavy sulphurets being treated by themselves, and the other portion being milled and concentrated. The mill yield was $10 00 per ton, and about $7.50 was contained in the sulphurets and not free to amalgamate. The concentrates ran $30.00 per ton. The ores contain from 1½ to 3 per cent. of copper. The exstraction of gold by chlorination was as high as 90 to 95 per cent. The mill and chlorination plants are now dismantled.

The "Middle" vein, lying 200 feet southeast of the "Phœnix," was formerly worked by open pitting; towards the northeast it appears to approach the Phœnix. Masses of sulphurets were found here, assaying as high as $36.00 per ton.

About 1,000 feet to the southeast of the Middle vein is a heavy sulphuretted lode, composed mainly of chalcopyrite in a gangue of quartz and barite. The old workings, which were shallow, are now inaccessible. Assays of the surface ore show 22 per cent. copper and $42.00 gold and silver per ton.

The Barrier Mine is 1 mile southwest from the Phœnix, on the same property, and was formerly open to a depth of 160 feet. It is stated (by Mr. Orchard) that there are two veins here, 12 feet apart, the one 14 inches thick and perpendicular, and the other 16

inches thick and inclined; at 160 feet they are only 2 feet apart. The ore is reported to have been worth $3.00 a bushel ($60.00 a ton. This mine was last worked, previous to 1860, by Mr. Orchard (deceased), and has not been operated since.

Adjoining the Phœnix on the northeast and west boundaries are the *Furness* and the *Gibb mines*, which were worked in former years, and are reported to have yielded high grade sulphuretted ores. A shaft has recently been sunk on the Furness property, but the results of the exploration are not known.

THE FAGGART MINE is 3 miles northeast of the Phœnix. It was opened by a shaft 100 feet deep, with a drift probably 50 feet in length. The vein is 18 inches wide, and composed of auriferous quartz and pyrite, having a stated value of $7.00 per ton.

THE BARNHARDT MINE[1] is 1½ miles east of the Faggart. The quartz vein, carrying galena and chalcopyrite, lies in diorite or diabase. It is reported to be 5 feet in width; with a value of $9.00 per ton, in gold. A small stream on the property was worked for years, and has furnished very coarse gold, up to 5 and 6 pennyweight pieces.

THE TUCKER (OR CALIFORNIA) MINE is about 1 mile south of the Phœnix, and about one-third mile west of the junction of the granite and the schists. When last worked (about 1884) the main shaft had reached a depth of about 175 feet, and levels aggregating 117 feet in length had been driven. The vein did not average over 8 inches wide, with northeast strike and nearly vertical dip. The ore was heavy in sulphurets (mostly pyrite with a little chalcopyrite) in a gangue of quartz and barite. Its value is stated to have been $15 per ton. In 1882 a Plattner chlorination plant was erected, with one single hearth reverberatory furnace, but it did not give satisfactory results, and the Mears process was introduced.

THE QUAKER CITY MINE is 3 miles north of the Tucker. There are 3 shafts on the property, 40, 60, and 80 feet deep, respectively. The vein is from 2 to 5 feet wide, and carries in its lower depths much iron pyrites with a little copper. The ore is low grade. It has not been operated during the past 10 years.

[1]Geological Report of the Midland Counties of North Carolina, 1856. E. Emmons. p. 178.

THE REED MINE[1] is situated 10 miles southeast of Concord. It is of especial interest as being the site of the earliest recorded discovery of gold in North Carolina, and it was the first mine to give celebrity to the gold fields of the Appalachian range, though probably not the first to yield gold.

In 1799 the first nugget, weighing 17 pounds, was accidentally found in a branch; and this was followed in 1803 by the discovery of a 28 pound nugget, the largest on record in the Eastern United States. Regular mining work was commenced shortly after this latter date, and during the subsequent period of 40 years, the mine yielded large quantities of gold. The proportion of large nuggets has not been paralleled on this side of the continent. Notwithstanding the fact that the gravel has been so long worked, there are some hollows or sinks of several acres in extent, which are almost virgin, but as the drainage is very imperfect they have never received the attention they deserve. The immediate supply of water is not large, but Rocky river and Buffalo creek might be tapped for the requisite supply for large hydraulic operations.

The mine might perhaps more properly be said to be in the Carolina Slate Belt, but the auriferous veins are confined to a large greenstone dike (reported to be 150 feet in width), and therefore it is placed here in the Igneous Belt. This greenstone is impregnated with pyrite, and contains quartz fissure veins, varying from 4 inches to 3 feet in thickness, and striking about N. 25° E., with a dip of 45° to 57° S. E. Cross fissures also occur. The main shaft is 120 feet deep. It was inaccessible in 1894. The mine was operated in a fitful manner from 1881 to 1887. During 1895 some prospecting and development work has been done; the old shaft on the "lower hill" has been opened up and retimbered; the west side of the "upper hill," the west and south sides of the "lower hill," and both banks of Little Meadow creek have been opened up for placer work; and a shaft has been sunk near the western limit of the property which has opened up a large body of low grade ore that is said to assay $7.50 per ton in free gold, and $11.55 per ton of gold the sulphurets. Preparations are being made for active mining.

[1]Geol. Report of the Midland Counties of North Carolina, 1856, E. Emmons, pp. 166-167.

THE PIONEER MILLS MINE[1] is situated 12½ miles south of Concord, on the waters of Caldwell creek, which flow into Rocky river. The mine has not been operated practically since the late war.

Only one exposure of the country rock rock was observed in place; it is a much decomposed granite. The old mine dumps show vast masses of a gabbroitic eruptive rock of various crystalline phases, from coarse to fine granular, and with alterations to a propyllitic type. A fine crystalline diabase, in part porphyritic, also occurs, and contains small quartz veinlets. A large specimen was found showing a sharp contact between the coarse crystalline gabbro (?) and the fine grained diabase. A very fine crystalline granite was also observed, which is perhaps a dike formation in the gabbro (?). The ore is quartz, containing iron and copper sulphurets, which sometimes show excellent banding, an example of incrustation. Siderite is one of the gangue minerals.

Other mines in this vicinity are the Morrison, Crosby (or Poplan), and Rogers, none of which are now accessible.

MECKLENBURG COUNTY.

Gold is probably more widely diffused in Mecklenburg than in any other county of the central part of the State. The productive area covers about 600 square miles, within which are well nigh 100 mines, which have at some time or other been worked profitably. About half a dozen of these mines are now worked, but only 2 or 3 with any vigor. The great number of these localities forbids a full description of each. Only those at work, or those which are considered the more important, can be described in the limited space of this report.

To a great extent they are capable of being grouped into smaller districts. The vicinity of Charlotte is one of these mineral districts, and around it are mines on all sides, among them the following: Davidson, Blake, Point, Parks, Clark, St. Catherine, Rudisil, Smith and Palmer, McDonald, F. Wilson, Howell, Trotter, Carson, Taylor, Isenhour, and others unknown to the general public, and unnamed.

[1] Geological Report of the Midland Counties of North Carolina. 1856. E. Emmons, p. 178.

THE DAVIDSON MINE is 1 mile west of Charlotte, on the south end of Davidson Hill. It has been worked to a depth of 80 feet; the vein was 3 to 4 feet wide, and the ores were reputed good.

The Point Mine, at the north end of Davidson Hill, was worked to a depth of 160 feet. The oxidized ores extended much deeper than is usual in this region.

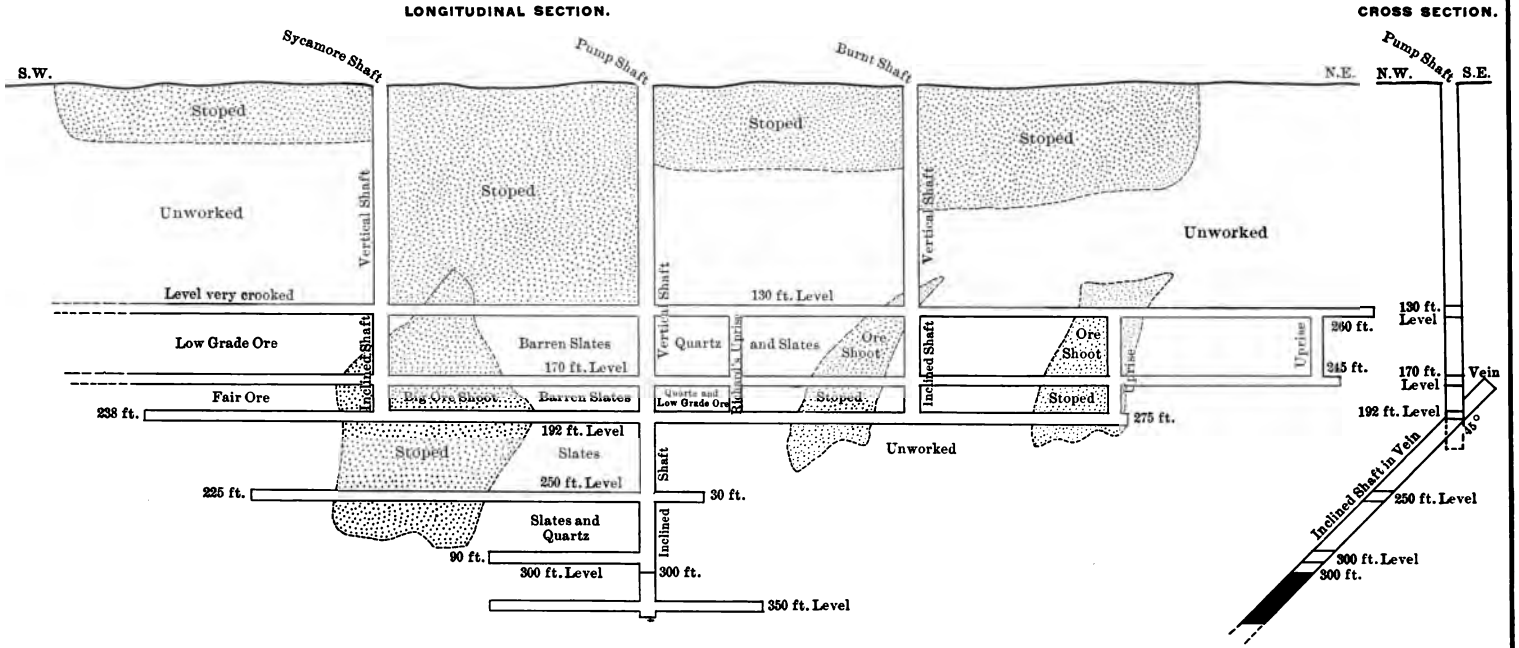
THE RUDISIL MINE[1].—The Rudisil and the St. Catherine mines are respectively in the south and the north parts of the same lode; the former is one mile, and the latter one-half mile south of Charlotte.

The bodies of ores in both mines nearer the surface lie in slates, which in places approximate 100 feet in width. These slates are both argillaceous and chloritic, everywhere siliceous, and frequently replaced by layers of quartz with ore. They are bounded by the country rock of the igneous belt, massive crystalline rocks.

At the outset, and to the depth of something more than 100 feet, two bodies of ore were recognized—the "back vein," and the "front vein," but the intervening mass of slate frequently carried subordinate bodies. Emmons[2] says of the Rudisil mine: "The rock both above and below the two veins, which constitute the mine, is the syenitic granite of the Salisbury and Greensboro belt; but the veins are immediately in killas or slate, which cannot be distinguished from the slates which predominate in the slate belt; and there are other points where the slate is in granite, and not less than 100 feet thick, which is traversed with veins of quartz. It is difficult to determine whether the slate thus situated is to be regarded as the killas of the vein, or as masses of the slate system isolated by an eruptive rock."

"Thus the Rudisil veins are between masses of an eruptive rock. * * * * The vein fissure is fifty feet thick, occupied by talcose slate, which is overlaid by white granite, and underlaid by elvan or a dark trappean rock. A vertical section, Fig. 11,

[1] Geol. Report of the Midland Counties of North Carolina. E. Emmons, 1856. pp. 176-177.
[2] Idem.



RUDISIL MINE.

Vertical (in part) longitudinal and cross sections, drawn from the notes of Wm. Jenkins and Wm. I. Smart, 1883. Scale: 1 inch=110 feet. The black color in the lower portion of the cross section indicates the unworked portion of the vein.

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shows the position of the two veins, lying one (b') against the elvan (a'), and the other (b) against the white granite (a)."

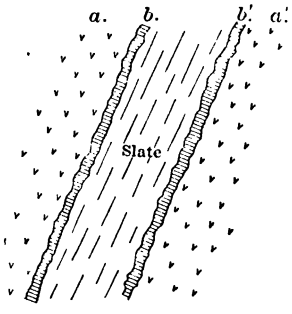


Fig. 11. Ideal vertical section across the Rudisil fissure.

The strike of the fissure approximates N. 30° E., and the dip 45° N. W. At the depth of 200 feet or more the slaty character becomes less evident, and ultimately disappears, seemingly giving place to the massive country.

The two ore bodies (front and back veins) vary considerably in width from 2 to 4, and sometimes 6 feet. At the depth of 200 feet they appear to approach.

The ore was carried in pockets in the slates (or schists), and in great abundance, so that for many years the mine was very prosperous. At the surface, and to a considerable depth, the mine material was the rich and easily treated brown ore of the region.

The zone below water level carried iron pyrite with a little copper pyrite; and the ore was scattered somewhat through a slaty and quartzose gangue, being less pockety than that above the water line. The assays for this zone as a rule showed material of only moderate value. At the 200 foot level the peroxides have mostly disappeared, and with them largely the free gold, though both are present in some proportion to the lowest level—350 feet below the surface. (See plate No. X.)

At greater depths the sulphurets were scattered thinly through a quartzose and somewhat slaty gangue, or in narrow seams, or concentrated in large, wide and rich shoots of nearly solid sulphurets. An inspection of the plate will show the position of these shoots—3 in number. As regards the northern shoot neither the point of origin nor its character are matters of record; it is not known above the 130 foot level.

The south and the middle ("Burnt Shaft") shoots began just above the 130 foot level in narrow threads, and expanded both in width and in length at greater depths. Neither the north nor the middle shoots have been followed below the 192 foot level to any extent, though slightly explored from the 250 foot level. The

north shoot increased from a mere seam to 5 feet in thickness, and had a length in the direction of the vein, varying from 30 to 50 feet. The material of this shoot was a high grade sulphuret, but not the best that the mine has furnished. The middle shoot increased in the same way to be 8 feet thick, extending longitudinally from 10 to 50 feet; the grade of ore is believed to have been somewhat higher than that of the north shoot.

It was, however, to the Big shoot (South shoot) that the mine has in recent years (as late as 1887) owed its reputation. It commenced like the middle shoot almost in a point, and gradually widened and lengthened with a slight south pitch of its own in the vein, till it became in places 15 feet thick, and 100 feet long; its ends were not abruptly marked off from the adjacent vein or from the "country," but passed gradually into mine material comparatively barren, or into "country" quite worthless.

The contents of the shoots, as a whole, were compact iron pyrite with a very little copper pyrite, and some quartz, which latter was, however, for the most part readily cobbed out. This ore was uniformly of high grade, entire shipments sometimes ranging as high as $180 per ton.

This shoot extended down a little below the 300 foot level, but in the 350 foot level it has never been found. There has been much speculation about it, and opinions have varied as to whether it had disappeared altogether, or was simply "thrown" from its normal position by one of the many deflections of the vein from its direct course.

It may be added in conclusion that the so-called barren parts of the vein carry pyrites scattered through the quartz and slate, and most of it is quite capable of being treated by a preliminary cobbing to separate the massive pyrites for direct metallurgical treatment, and at the same time prepare the lowest grade material for battery amalgamation and subsequent concentration preparatory to smelting or chlorination.

The following assays show the character of some material from this mine:

Assays, Ores and Concentrates, Rudisil Mine, Mecklenburg County.

Assays of Auriferous Pyrite scattered in gangue.

	(158)	(159)	(160)	(161)
Gold, per ton	$ 6.20	$ 9.30	$12.40	$20.67
Silver, per ton	trace	2.49	trace	.13
	$ 6.20	$11.79	$12.40	$20.80

Assays of First Class Ore, Rudisil Mine.

	(162)	(163)	(164)
Gold, per ton	$ 45.47	$ 72.35	$ 74.41
Silver per ton	trace	trace	trace
	$ 45.47	$ 72.35	$ 74.41

Assays of Second Class Ore, Rudisil Mine.

	(165)	(166)	(167)	(168)	(169)	(170)	(171)
Gold, per ton	$24.80	$28.70	$29.97	$31 01	$35.14	$35.14	$36.18
Silver, per ton	trace.	trace.	.19	trace.	.65	.96	.13
	$ 24.80	$27.70	$30.16	$31.01	$35.79	$36.10	$36.31

Assays of First Class Cobbed Sulphurets, Rudisil Mine.

	(172)	(173)	(174)
Gold, per ton	$165.36	$126.09	$227.37
Silver, per ton	.45	.94	1.71
	$165.81	$127.03	$229.08

Assays of Concentrates, Rudisil Mine.

	(175)	(176)	(177)
Gold, per ton	$53.74	$59.94	$67.18
Silver, per ton	2.90	1 73	1.14
	$ 56.64	$61.67	$68.32

The St. Catherine (Charlotte) Mine is located in the northeast extension of the Rudisil lode (page 126), the two mines being over half a mile apart. The region intervening has been prospected superficially, but as yet nothing of importance has been found which promised well for deeper operations. Both mines have the same general features, and agree in strike and dip.

The St. Catherine has been worked to a depth of 460 feet (155 feet vertical and 305 feet on the underlay, equivalent to a total vertical depth of 370 feet).

In the lower part of the mine the vein does not seem to be well consolidated, and the geological relations are perplexing. Below 250 feet there are several large shoots of low grade ore quite suitable for milling and concentrating, notably the ore body worked from the "pump" shaft and between the depths of 200 and 370 feet, below which point it has not yet been removed. The occurrence may be briefly stated as a series of obscurely parallel seams of slate, with quartzose ore bodies 2 to 6 feet in

thickness between; the amount of pyrite in this class of ore is small.

A cross vein (striking N. W. and S. E.) has been examined from the 155 foot level for a distance of 100 feet along the vein.

The following assays show the range in character and value of some of the ores of this mine:

Assays, Gold Ores, St. Catherine Mine, Mecklenburg County.

Assays of Brown Ores.

	(178)	(179)	(180)	(181)
Gold per ton	$ 26.87	$ 39.27	$ 56.87	$108.35
Silver " "	.71	.58	.38	.88
	$ 27.58	$ 39.85	$ 57.27	$104.23

Assay of Quartz, with Dissemminated Pyrite, St. Catherine Mine.

	(182)
Gold, per ton	$24.80
Silver, "	.16
	$24.96

Assays of First Class Ores, St. Catherine Mine.

	(183)	(184)	(185)
Gold, per ton	$ 52.19	$ 53.74	$ 72.41
Silver, "	.55	trace	.39
	$ 52.74	$ 53.74	$ 72.80

Assays of Second Class Ores, St. Catherine Mine.

	(186)	(187)	(188)
Gold, per ton	$ 35.14	$ 33.07	$ 35.14
Silver " "	1.14	trace	.28
	$ 36.28	$ 33.07	$ 35.42

Assays of Cobbed First Class Ore, St. Catherine M2ne.

	(189)	(190)	(191)
Gold, per ton	$95.08	$108.52	$181.38
Silver, "	.41	trace	trace
	$95.49	$108.52	$181.38

Assays of Concentrates, St. Catherine Mine.

	(192)	(193)	(194)
Gold, per ton	$40.31	$ 66.14	$133.32
Silver, "	1.10	1.23	1.23
	$41.41	$67.37	$134.55

In 1883 a ten stamp mill was erected. The ores were first subjected to a preliminary cobbing, which separated out the massive pyrites and lean ore, the latter going to the stamp mill. The free gold was caught in the batt[illegible]d on the plates in the customary mode of amalgamation, and the tailings led directly to Frue vanners, where the product was concentrates. The cobbed pyrites and concentrates were shipped north and elsewhere for treatment.

The proportion of massive pyrites to the whole material mined (except when near a rich chimney) was small, probably not more than 2 or 3 per cent.

In the common run of mining and milling practice it required 10 to 15 tons of ordinary ore to make one ton of concentrates, which ordinarily contained 80 to 90 per cent. sulphurets. It is worthy of remark that the concentrates, however high the per cent. of sulphurets, rarely contained as much gold per ton as cobbed ore of the same richness in sulphurets.

The last work at the St. Catherine, of which the writer is aware, was in 1887.

THE SMITH AND PALMER MINE is 1 mile south of Charlotte, in the Rudisil neighborhood. It is a mooted point whether the vein be an extension of the Rudisil, or a parallel body. Its strike is N. 30° E. and dip 50° N. W. A line of pits indicate vein matter for something more than 500 feet along the strike. The greatest depth of the workings was 75 feet, and the width of the vein from 2 to 4 feet. Assays of some samples show:

Assays, Gold Ore, Smith and Palmer Mine, Mecklenburg County.

	(195)	(196)	(197)	(198)	(199)
Gold, per ton	$ 5.17	$ 5.17	$ 15.51	$ 15.51	$ 148.82
Silver, per ton	trace	.39	trace	.26	.91
	$ 5.17	$ 5.46	$ 15.51	$ 15.77	$ 149.73

Two other veins in the neighborhood deserve mention in this connection, namely, the Frank Wilson and the McDonald. The former has hardly been touched; the latter has been worked to a moderate depth, but no record of the work has been preserved.

THE HOWELL MINE is believed to lie in the southern extension of the Rudisil lode. It has been worked to a depth of 32 feet, and something more than 50 feet of levels have been driven. The vein is stated to be 2 to 4 feet wide. Assays of the brown ores show $5 to $14 per ton, and of the sulphurets $38 to $77.

THE TAYLOR MINE is 3 miles southwest of Charlotte, and the *Isenhour* is still further in the same direction. Each of these has been worked for a distance of about 400 feet along the vein, but to a very moderate depth.

THE TROTTER MINE is 3 miles sonthwest of Charlotte, and its vein is cut by the Southern R. R. (Charlotte & Atlanta line.) It

has been prospected nearly 450 feet in length, and worked 70 feet in depth. Some rich specimens were taken from the mine.

THE CLARK MINE is 2½ miles west of Charlotte. There appear to be two vein systems, one lying approximately northeast and southwest, and the other nearly east and west. Both have a steep dip southward. The northeast and southwest system was worked to a depth of 70 feet, and from the line of pits the inference is reasonable that it must have been worked along the strike of the vein for a distance of about 1,200 feet. It is alleged that this part of the mine was abandoned on account of flooding by water.

Assays of samples taken from this vein yield the following results:

Assays, Gold Ores, E. and W. Vein, Clark Mine, Mecklenburg County.

	(200)	(201)	(202)
Gold, per ton	$ 5.17	$ 31.01	$ 146.76
Silver, per ton	trace	1.21	.29
	$ 5.17	$ 32.22	$ 147.05

The east and west vein was worked to a depth of 78 feet. In the 72 foot level 3 bodies of low grade brown ore were found within a space of little less than 25 feet; they measured respectively 2 ft., 4 in.; 7 ft., and 7 to 12 in.; the latter body was the only one rich enough to work, and an average sample showed $16 per ton, assay value.

The Parks Mine is 1 mile northeast of Charlotte; no great depth was ever attained in its workings.

A second group of mines is found 5 to 10 miles west and northwest of Charlotte, embracing the Hayes, McGee, Brawley, Frazer, Hipps, Campbell, Todd, Arlington, Capps, McGinn, Means, Bennett, Stephen Wilson, Gibson, Neal, Trautman, Prim, Abernathy, Alexander, Dunn, Sloan, McCorkle, Cathey and several others.

THE BRAWLEY MINE is 4 miles west of Charlotte. It has been quite productive, and the quantity of rich float quartz was large, but all efforts to find a vein have proved abortive. The work thus far done would indicate the existence of a net work of quartz seams.

THE TODD MINE is situated 5 miles northwest of Charlotte. There are two, and possibly three, veins on the property. The vein which was most extensively worked strikes east and west, and dips 45° southward. It has been penetrated to a depth of 80 feet. Some explóratory work was done at this mine in 1886, and a ten stamp mill erected.

THE ARLINGTON MINE is 6 miles west of Charlotte, and has been sunk to a depth of 70 feet.

THE STEPHEN WILSON MINE is 9 miles west of Charlotte. The property comprises 340 acres, and it is stated that 10 well defined veins have been located. Of these only two have been worked, namely, No. 2 and No. 3. Both of these have a strike nearly east and west, and dip southward, No. 2 from 26° to 45°, and No. 3 a little more steeply. No. 2 vein is from 2 to 3 feet wide; it was entered by an underlay shaft to a depth (on the incline) of 400 feet, and 4 levels run. The ores carry iron and copper pyrites. Some very rich ores have been mined. Assays show the following results:

Assays, Gold Ores, Stephen Wilson Mine, Mecklenburg County.

	(203)	(204)	(205)	(206)	(207)	(208)
Gold, per ton	$ 0.83	$ 24.80	$ 51.22	$ 95.08	$155.03	$344 67
Silver, per ton	.26	.90	.88	2.46	1.55	1.29
	$ 1.09	$ 25.70	$ 52.10	$ 97.54	$156.58	$345.96

The Gibson and Neal mines adjoin the Stephen Wilson.

THE CAPPS MINE is situated 5½ miles northwest of Charlotte, between the Rozzel's Ferry and Beattie's Ford roads. It is located on a group of veins of which two are closely convergent (the Jane and the Capps). By the accident of different ownerships, they have been for the most part separately and differently developed. The Capps vein has a strike N. 30° to 35° W., and a dip westerly, with some variations, of about 40°. The Jane vein runs N. 40° to N. 60° E., and has a very steep pitch eastward. It is not certain that the actual intersection of these veins has been found. The Capps vein has an ascertained length of nearly 3,000 feet, and the Jane probably fully as much.

As the development of these two veins has been separate, the description will follow the course of the work.

The accompanying sketch (fig. 12) shows the relative position of the veins, properties, shafts, and worked areas. It shows also the position and relations of the McGinn Copper vein.

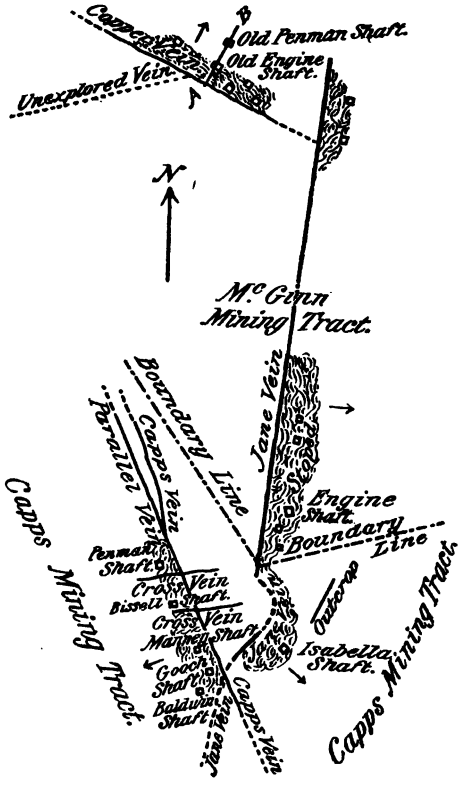


Fig. 12. Capps and McGinn Mining Tracts, Mecklenburg County.
[Scale: 1 inch to 75 rods.]

The later work on the Capps was restricted, and finally stopped, from legal considerations, but the earlier work extended very nearly along the line of the outcrop of the entire vein—2,000 to 3,000 feet—and was carried to such depths as to disclose clearly the character of the outcrop. At points where the ore proved to be exceptionally abundant and valuable, operations were extended much deeper. There is perhaps no vein in the whole section which shows such extensive prospecting on the surface, and bears all the appearance of having been highly remunerative.

It is much to be regretted that there are such scanty records of the earlier work, and of the characteristics of the veins and deposits. The outcrop of the vein at many points still shows a width of 20 to 25 feet, and the debris everywhere indicates a very wide vein.

The ores near the surface are the customary soft brown ores with quartz, and are generally free milling.

They were not uniformly disseminated in the quartz, but generally occurred in layers, sometimes near the hanging wall, sometimes near the foot wall. At greater depths sulphurets of iron (and to a small extent, of copper), together with quartz, were found; nevertheless, at the depth of 130 feet there was still much brown ore.

The work was never prosecuted to any great depth—at the Gooch shaft 70 feet, at the Bissell 130, and at the Penman 65 feet.

The filling of this vein is quartz; its width is not known, for no systematic work has ever been undertaken to find the walls; it cannot be less than 20 feet, and possibly is considerably more.

The line separating the veins from the walls is not always sharp and definite, and occasionally, where the supposed hanging wall had been reached, another and valuable parallel body of ore was found still further beyond, which ultimately came back to the main vein.

There are also "cross courses," leading into the main vein nearly at right angles. One of the most conspicuous and valuable of these was found in the 130 foot level, at the distance of 225 feet southeast of the Bissell, and about one-half way between the Bissell and Mauney shafts. It received temporarily the name of the "East and West vein," for want of exact data as to its relations to the main vein. This body departs abruptly from the main vein easterly and towards the Jane vein, and has been followed in that course 120 feet, and almost every foot of the vein material was ore. The width of this deposit could not have been much less than 18 to 24 inches, and the ore was of more than average value.

A few feet further north there is a similar cross course or body of ore, but so far as explored it was not so valuable as the "East and West vein."

The Capps mine has been noted for the amount of ore it could furnish, and for the superior grade of its ore. There are four well known bodies of ores. The first of these is near the Gooch shaft, toward the south end of the mine, and from the 78 foot level downward it yielded largely brown ore with some sulphurets, and seemed to improve in character going south.

The second body is in the 78 foot level from the Mauney shaft. Not much can be said with precision respecting the value of this ore, though the upper part of the body toward the surface yielded an ore of high grade.

A third and very large ore body was worked out through the Bissell shaft to the depth of 90 feet. The entire length of this level is 300 feet, of which 200 feet are to the north, and 100 feet to the south of the shaft; the whole of this distance was ore, free-milling to a great extent above, but more and more sulphuretted below; it has never yet been entirely extracted above the 90 foot level, but the best part of it has been stoped out. Below the 90 foot level the ore has not been stoped out at all, except as it was necessary to remove it in running the levels. The body has been explored by a few winzes run downward toward the 130 foot level. Its connection with the large body developed in the 130 foot level has not yet been established conclusively, but there seemed to be little doubt from its position and character that there is such a connection. This body in the 130 foot level is found at a point 125 feet south of the Bissell shaft, and extends north as far as the work has been prosecuted. The shoot cannot be less than 200 feet long, and judging from the 90 foot level, it may be 300 feet.

Some assays of the ores from this shoot are as follows:

Assays, Gold Ores, Third Ore Body, Capps Mine, Mecklenburg County.

	(209)	(210)	(211)	(212)	(213)	(214)
Gold, per ton	$ 11.72	$ 15.51	$ 17.92	$ 25.84	$ 49.61	$ 132.29
Silver, per ton	trace	.32	.14	.13	.97	.84
	$ 11.72	$ 15.83	$ 18.06	$ 25.97	$ 50.58	$ 133.13

Assay No. 211 is an average of a large body of ore from this 130-foot (?) level.

A fourth body was found in the bottom of the Penman shaft, 335 feet north of the Bissell. The stopings north of the inclined shaft are very extensive and reach to its bottom; the ore body could not have been less than 3 feet thick on an average, and this increased in one place to be 8 feet; a very little good ore is still to be seen at the bottom.

The deposit in this part of the mine is comparatively shallow, and is, and will continue for some distance, free-milling. The facts recited will justify the expectation of large and valuable bodies of ore at still greater depths.

That part of the Jane vein on the Capps mining tract was worked in part from the Isabella shaft to a depth of 160 feet. There is no record of the value of the ore body at this point; common report speaks well of it, but admits the refractory character of the ore.

The Capps mine was reopened in 1882, and during the following year some ore was shipped to the Designolle works, 4 miles south of Charlotte. However, this process of reduction was unsatisfactory. In 1884 a ten stamp mill was erected at the mine, and the ores from the dump were milled; shortly after that time all operations ceased. In the spring of 1895 four diamond drill holes were bored on the Capps vein, respectively 340, 255, 180 and 170 feet deep. The vein was cut by each hole, and showed a thickness of 20 feet, with a dip of about 30° S. W. The walls were fine and coarse grained diorite, at times porphyritic. Assays of the vein matter from the drill cores gave $6 to $7 per ton.

THE MCGINN MINE adjoins the Capps on the north. The accompanying sketch map (Fig. 12, p. 134) shows three veins, one of which has never been explored, the second is the Jane,

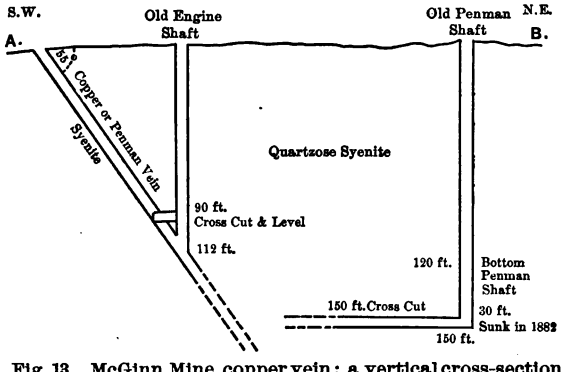


Fig. 13. McGinn Mine, copper vein; a vertical cross-section through the old engine shaft shown in Fig. 5 of Plate XI, and on the line A-B of Fig. 12, page 134.

and the third is the Copper vein. The appearance and relations of these veins and of the ore bodies are shown in the sections on Plate XI, and in figure 13 (p. 137).

The Jane vein has been worked from various points, and especially from the Engine shaft (150 feet), at which point all of the readily accessible ore bodies above the 150 foot level have been extracted. A glance at plate XI will show an ore body not much less than 35 feet wide, at points, and at the same time will disclose in the clearest manner some of the characteristics of the vein structure, common to this and to other mines.

The Copper vein was operated extensively for copper to a depth of 110 feet, i. e. as far down as could readily be done some 50 years ago, with the appliances then at command. The ore was yellow sulphuret, and was shipped from the State for treatment.

The following assays are appended:

Assays, Gold Ores, Jane Vein, McGinn Mine, Mecklenburg County.

	(215)	(216)	(217)	(218)	(219)	(220)	(221)
Gold, per ton	$ 2.07	$ 5.17	$ 23.25	$ 28.42	$ 99.22	$108.52	$113.68
Silver, per ton	1.20	1.74	.31	.31	.71	1.65	.77
	$ 3.27	$ 6.91	$ 23.56	$ 28.73	$ 99.93	$110.17	$114.45
Copper, per cent		8.05%				4.55%	

Assays, Ores from Copper Vein, McGinn Mine, Mecklenburg County.

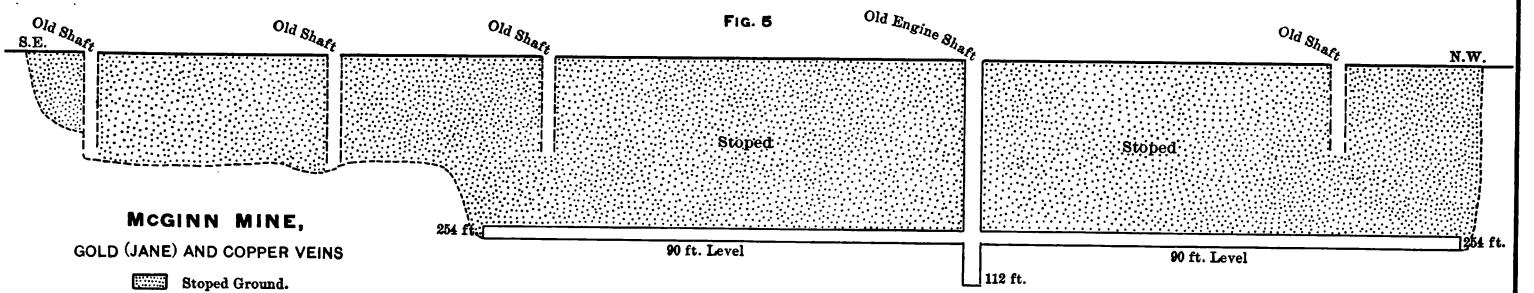
	(222)	(223)	(224)
Gold, per ton	$ 5.17	$ 10.85	$ 12.40
Silver, per ton	1.74	1.65	1.20
	$ 6.91	$ 12.50	$ 13.60
Copper, per cent	7.50%	4.55%	8.05%

THE MEANS MINE is situated ½ mile nearly southeast from the Capps. By some investigators it is thought to be a continuation of the Jane and by others of the Capps vein, but it scarcely seems probable that either of these opinions is correct.

The vein has been worked at different points, and in the Wallace shaft to a depth of 175 feet. The present work is at a vertical depth of 25 feet (36 feet on the incline), but preparations are being made for sinking to a new level. The exposure at the face of the drift on the 25 foot level is represented in the accompanying section (fig. 14). The strike at this point is N. 35°–40° E. The ores carry much

Fig. 14. Showing Section across Ore body in Means Mine.

FIG. 5



McGINN MINE,

GOLD (JANE) AND COPPER VEINS

Stoped Ground.

FIG. 1

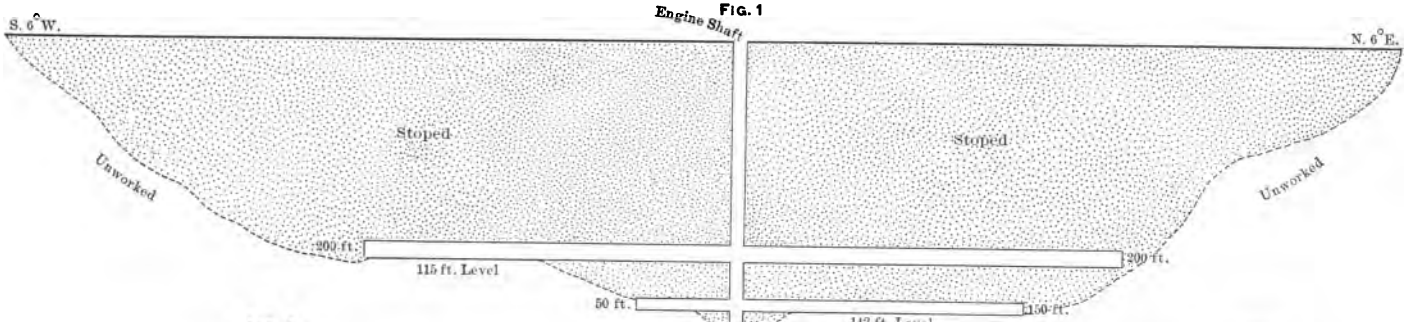


FIG. 4

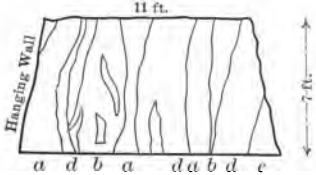
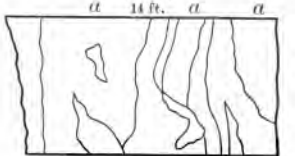


FIG. 2

FIG. 3



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chalcopyrite. The precious metal content is shown by the following assays.

Assays, Ores from the Means Mine, Mecklenburg County.

	(225)	(226)
Gold, per ton	$ 7.02	$ 28.44
Silver, per ton	1.65	1 94
	$ 8.67	$ 30.38

THE HOPEWELL (OR KERNS) MINE is 11 miles northwest of Charlotte. It yielded well in former years. The last work was done at the depth of 140 feet. Conflicting statements have been made respecting the amount and value of the ore at this depth. The manager's statement is that at the depth of 80 feet there were two veins aggregating 5 feet in width, and at 140 feet a two foot vein of good yellow copper ore. Some assays of the ore from this mine show:

Assays, Ores from the Hopewell Mine, Mecklenburg County.

	(227)	(228)	(229)
Gold, per ton	$ 4.13	$ 12.40	$ 16.53
Silver, per ton	trace	trace	1.10
	$ 4.13	$ 12 40	$ 17.63
Copper, per cent	18.83%	17.08%	12.23%

THE GREEN C. CATHEY MINE, 8 miles northwest of Charlotte, carries copper ores, and has been explored sufficiently to develop an ore body of good grade. Some assays of ore from this mine show:

Assays, Ores from the G. C. Cathey Mine, Mecklenburg County.

	(230)	(231)	(232)
Gold, per ton	$ 8.27	$ 7.23	$ 14 47
Silver, per ton	1.23	3.88	.39
	$ 9.50	$11.11	$ 14.86
Copper, per cent	14.84%	25.40%	

The Sloan mine adjoins the G. C. Cathey, and has been worked to a depth of 40 feet.

THE CHAPMAN (OR ALEXANDER) MINE is in the same vicinity, near the Rozzel's Ferry road. It has been worked to a depth of 110 feet, and at 90 feet levels have been driven 75 feet in either direction.

The length of the vein on the property is 900 feet; the strike is N. 20° W., and the dip 65° to 70° N. E. The vein matter is made up of silicified schists with seams of brown ore and quartz; in depths sulphurets are abundant. The width of the vein occasionally reaches 9 to 10 feet, but the ore seams range from 4

inches to 2½ feet in thickness. Some assays of average samples from the head of the north and south level gave $12 to $13 per ton. An assay of an average sample of the brown ore seams ran $28; and of the dump-pile, after sorting out the sulphurets, $13. The sulphurets, which had been sorted out, gave $48.00. Other assays of the ore from this mine gave:

Assays, Ores from the Chapman Mine, Mecklenburg County.

	(233)	(234)	(235)	(236)	(237)
Gold, per ton	$ 4.13	$ 20.67	$ 22.74	$ 23.77	$ 35.14
Silver, per ton	trace	trace	1.29	1.10	.74
	$ 4.13	$ 20.67	$ 24.03	$ 24.87	$ 35.88

THE DUNN MINE is 2 miles northwest from the Alexander, towards Rozzel's ferry, on the west side of Long creek.

It was the first mine discovered in the county, not long after the finding of the nuggets at the Reed mine in Cabarrus county, in the first years of the present century.

The "East vein" was the first to be mined, but the ore soon changed to copper pyrites, which, though auriferous, proved to be too refractory to be treated by the methods then in vogue, and the vein was abandoned after working to a depth of 20 feet. Above this point the ores were mostly peroxidized. The vein is 6 to 12 inches wide; its course is nearly north and south, and its dip west.

The deposit which has been most largely worked is known as the Main vein—a body of slates bearing northeast and southwest, and dipping southeast at an angle of nearly 45°. This body of slates extends across the property for a distance of ½ mile along its outcrop. It contains deposits of quartz and brown ores (including a very hard red hematite, more nearly resembling specular iron), cellular quartzose ores, and compact pyrites, including some copper pyrite. Another "vein" is found 50 feet back of this, but the sections indicate that the whole is one body, with a front and a back seam of ore, and not properly two veins. The appearance at the 60 foot level, where three bodies of ore are seen within a few feet of each other, gives strength to this view, that they are subordinate seams of the same vein, and makes it a

not unreasonable supposition that they may combine in depth to form one ore body.

The underground work consists of a shaft 60 feet deep, and a second shaft of 90 feet, which is considerably to the east of the veins; a cross-cut has been driven from the bottom of this shaft to meet the veins. The 60 foot shaft is connected with the 90 foot shaft by a level (the 60 foot level) across the formation. Three, if not four parallel bodies of ore are cut across by this level. These bodies are composed of silicified slates, varying from 3 to 5 feet each in thickness, and with an aggregate thickness of not less than 12 feet. No drifting had been done on these parallel bodies, and their character and strength is not known.

The following assays show the variation of different samples of ore:

Assays, Gold Ores, Dunn Mine, Mecklenburg County.

	(238)	(239)	(240)	(241)	(242)
Gold, per ton	$ 8.27	$ 10.33	$ 28.94	$ 128.44	$ 26.17
Silver, per ton	trace	trace	1.94	trace	trace
	$ 8.27	$ 10.33	$ 30.88	$ 128.44	$ 26.17

Nos. 238-241 were samples of ores from upper portion of the mine.
No. 242 was a sulphuret sample.

THE CATHEY MINE is 5 miles southwest of Charlotte. A large body of chalcopyrite was uncovered in the workings, and the ore was shipped from the State for reduction. A depth of 75 feet was attained when work was suspended.

THE MCCORKLE MINE is 8 miles southwest of Charlotte. The workings extended to a depth of 50 feet, and the ores were brown oxides, and iron pyrites.

A third group of mines is found from 5 to 7 miles north of Charlotte, including the Henderson, Ferris, and others.

THE HENDERSON MINE is situated 7 miles north of Charlotte. The longitudinal extent of the workings appear to have been fully 300 feet. The strike of the vein is N. 40° E., and the dip S. E. The deepest shaft is 100 feet, and three bodies of ore were worked from it; they vary in size from 1½ to 4 feet in thickness; in the lower workings the sulphurets predominate, but the brown ores had not entirely disappeared. Assays show variations from $14 to $75 per ton.

THE JOHN P. HUNTER MINES are situated from 1 to 2 miles southwest of the Henderson. Judging from the outcrops and the float ore, there appear to be 5 veins; but only one of these has been prospected, and that only to a depth of 25 feet. The strike is N. 40° E., and the dip S. E. The Elwood vein is ¾ mile further west.

THE FERRIS (FAIRES) MINE is situated 6 miles north of Charlotte. There are two veins on this tract, and a third on an adjoining tract. The two veins first mentioned are believed to unite towards the south, and to form the third vein alluded to—the Garris vein.

The "North" vein has been worked most extensively. The "South" vein is 300 to 400 feet southwest of the former; it strikes N. 25° E., and dips 45° S. E. In width it varies from 2 to 7 feet, and has a pay streak from 18 inches to 4 feet wide. The rich brown ores of the upper levels give place at greater depths to sulphurets, and at the 90 foot level these are quite compact. The ores carry some chalcopyrite. The following tables give the results of assays of both the brown ores and the sulphurets:

Assays, Brown Ores, Ferris Mine, Mecklenburg County.

	(243)	(244)	(245)	(246)	(247)	(248)
Gold, per ton	$ 13.43	$ 18.60	$ 28.94	$ 40.31	$111.62	$126.09
Silver, per ton	2.80	1.81	trace	4.72	trace	2.57
	$ 16.23	$ 20.41	$ 28.94	$ 45 03	$111.62	$128.66
Copper, per cent	14.23%					

Assays, Sulphurets, Ferris Mine, Mecklenburg County.

	(249)	(250)	(251)
Gold, per ton	$ 40.31	$ 72.34	$506.41
Silver, per ton	4.72	trace	7.52
	$ 45.03	$ 72.34	$513.93
Copper, per cent	13.66%		

The Garris vein is the one at present worked. It shows a large outcrop, and is entered by two shafts, one 90 feet and the other 120 feet deep. The vein fissure strikes N. 25° E., and dips 70° N. W. It is stated to vary from 2½ to 5 feet in width, and is composed of seams up to 12 inches in thickness of milky quartz, carrying iron and some copper sulphurets, and separated by hydromicaceous schists. The ores are worked in a chilian mill of 3 tons capacity. It is stated that the quartz contains nearly 25 per cent. sulphurets, the concentrates from which

assay $45 to $60 per ton. Some assays of ore from this vein give the following results:

Assays, Gold Ores, Garris Vein, Ferris Mine, Mecklenburg County.

	Gossan. (252)	*Kidney Ore.* (253)
Gold, per ton	$ 5.17	$53.74
Silver, per ton	trace	trace
	$ 5 17	$53.74

Other mines in this group are the Alexander, northwest of the Ferris, and the Nolan and Caldwell mines.

A fourth group of mines is situated in Providence township near Sardis church, some 5 to 10 miles southeast of Charlotte: among others the Hunter, Tredinick, and Ray mines.

The Hunter Mine is 5 miles southeast from Charlotte, near Sardis church. There are two veins, and outcroppings of several others, but there is no record of the amount of work done, nor of the extent of the ore bodies. Recent explorations show a small amount of ore still accessible, assays of which ran from $20 to $45 per ton.

The Tredinick Mine is 7 miles southeast of Charlotte. It has been prospected to a depth of 80 feet, and for a length of 200 to 300 feet. The vein is 1 to 2 feet wide, and carries a relatively large amount of copper minerals.

The Ray Mine is situated from 9 to 9½ miles southeast of Charlotte, and within one mile of Matthews. It is the property of the Baltimore and North Carolina Mining Company, comprising 360 acres of land. There are 5 veins with an aggregate length of about 4 miles. The South vein has been worked to a depth of about 60 feet, and the Phifer Grove vein to a depth of 40 feet. The mine material from both was free-milling brown ore. The Ray vein, the best known of them all, is entered by 6 shafts, the deepest being 250 feet. The ore seam is 6 to 8 inches thick, and is filled with nearly compact sulphurets. Most of the ore, down to the 120 foot level, has been stoped out. The levels from the southernmost shaft uncovered a large and fine body of auriferous chalcopyrite. The following assays of ore from this mine are appended:

Assays, Gold Ores, Ray Vein, Ray Mine, Mecklenburg County.

	(254)	(255)	(256)
Gold, per ton	$ 20.67	$ 31.01	$ 223.23
Silver per ton	.32	.97	3.88
	$ 20.99	$ 31.98	$ 227.11

Assays, Gold Ores, Phifer Grove Vein, Ray Mine, Mecklenburg County.

	(257)	(258)
Gold, per ton	$ 20.67	$ 31.00
Silver, per ton	.32	.97
	$ 20.99	$ 31.97

The Pioneer Mills group of mines in Cabarrus county (see p.125) extends into the southeastern part of Mecklenburg county. The Johnson, Stinson, Rhea, Maxwell, Simpson, and Black mines belong here.

The Simpson Mine is in Clear Creek township, 10 miles east of Charlotte. The property has several veins, which carry quartzose ores, with a little sulphurets, including chalcopyrite. Assays of the ore show values from $1.00 to $45.00 per ton.

The Black Mine, 10 miles east of Charlotte, has a small but very rich vein of brown ore, of which assays show values from $50.00 to $236.00.

In Clear Creek township, 10 to 12 miles a little south of east from Charlotte, is an interesting group of mines. The grouping comprises two series of veins striking in diverse directions; one approximately northeast and southwest, and the other N. 60° W.

Of the northeast and southwest running series the most northerly vein is the Beaver, ½ mile east of Mungo's store; then two parallel veins, the Brafford and Ellington; and about 300 yards still further south, the Surface Hill.

The Ellington in its middle portion is known as the Blair, and in its southwestern continuation as the Hard Hill vein.

The second series of veins (northwest and southeast running) is something like one mile further west, and ½ mile southwest of Mungo's store. The mines in their order, commencing at the north, are: The Ferguson Hill, A. J. Wilson, Shaffer, and the Poplin.

The Survey has no detailed information respecting the Beaver, the Brafford or the Ellington.

THE SURFACE HILL MINE has long been known for its large yield of nuggets. It is situated on a high plateau in Clear Creek township, from which flow McAlpine's creek to the southwest, Reedy creek to the northeast, and Clear creek to the southeast.

The country rock is granite, which is apparently intersected by a system of reticulated quartz veins or veinlets; and these, in consequence of the general disintegration, have scattered their contents widely over and beyond the 66 acres comprising the tract. There appear, moreover, to be two veins of some size crossing each other, viz: the main or Harris vein striking N. 45° E., and the Lidner or Vivian vein striking N. 10° W.

The rich pocket of nuggets, which has given the mine its celebrity, appears to lie near the junction of the two veins, and a little to the north, where a dike has cut across them. It is stated that the nuggets were found most abundantly between the dike and the north end of the Harris vein. It is quite certain that several thousand pennyweights must have come from the space of a few square feet.

A considerable amount of brown ore of good appearance, carrying copper sulphurets, has been mined in the process of hunting for nuggets, but as an ore it is of little value, despite its fine appearance. Assays show but $2.00 to $3.00 per ton.

THE A. J. WILSON MINE was first opened in the early part of 1895, to a depth of 30 feet. The vein is of considerable width but has not been exposed from wall to wall. The pay streak was from 8 to 14 inches, carrying compact hematite and some pyrite. The strike is N. 63° W., and the dip 55° N. E. The assay of an average sample showed $13.80 per ton.

Little is known of the Shaffer, Ferguson Hill and Poplin mines, all of which have been extensively worked, but whose records have long since disappeared.

On the Elliotte plantation, 5 miles south of Charlotte, are 6 veins, but none have been prospected. Five of these are grouped in a space of ½ mile; they range from 3 to 6 feet in thickness, and carry quartz, brown ore and sulphurets. Assays of the ores show results ranging from $6.00 to $45.00 per ton of gold and silver, and some copper.

CHAPTER VI.

THE KINGS MOUNTAIN BELT AND ITS GOLD DEPOSITS.

This belt occupies an area of indefinite and imperfectly known boundaries, adjoining the Carolina Igneous Belt on the west. The localities in which mines are situated are few and widely scattered, in Gaston, Lincoln, Catawba, Davie and Yadkin counties.

The country rocks are crystalline schists and gneisses, and occasional lenticular bodies of siliceous, magnesian limestone and beds of quartzite. The strike of the schistosity is northeast, and the dip usually westward, at steep angles. The gneisses are micaceous; the schists, micaceous, chloritic, argillaceous, and sometimes graphitic. Pegmatite dikes are frequent in some localities, and in the Kings Mountain district of Gaston and Cleveland counties they are tin-bearing. The quartzites are apparently confined to the higher ledges of Kings, Crowders, Anderson, etc., mountains, a line of isolated peaks and ridges stretching from the South Carolina line northeastward. The limestone occurs along the foothills and low lands bordering these ridges, in small, irregular lenticular bodies, usually separated by slates or schists, and often buried without cropping out on the surface.

GASTON COUNTY.

THE KINGS MOUNTAIN (OR CATAWBA) MINE[1] is situated 1½ miles nearly south of Kings Mt. station on the Southern R. R. It lies in the narrow limestone belt, which skirts the western base of Kings and Crowders mountains.

The ore is a mixture of the siliceous magnesian limestone and quartz, and exists in large lenticular chimneys, pitching to the northeast. The strike is N. 20° E., and the dip 45° to 60° westward. It is stated that five ore lenses or chimneys, which extend to the surface, have been opened. In length they reach 100 feet,

[1]Geological Report of the Midland Counties of North Carolina. E. Emmons, 1856. pp. 168, 169.

and in width 20 feet. They are separated by black, graphitic slate, carrying coarse crystalline iron pyrites, which are, however, stated to be barren. The total width of the ore bearing ground is from 60 to 150 feet. At one point in the mine the limestone is horizontally banded, blue and white; the schistosity of the slates is at a steeper angle, and it would appear that both the limestone and slate were sedimentary.

The gold is present largely in the free state; the sulphurets (pyrite, chalcopyrite and galena) aggregate from 2 to 3 per cent; tellurides are of occasional occurrence.

The mine was discovered in 1834, and is said to have yielded $750,000.00 during its past history. It has been opened to a depth of 320 feet, and was last worked in a small way during the past summer (1895). The equipment consists of a 30 stamp mill with 5 Frue vanners.

The value of the ore is difficult to estimate intelligently. Various assays show the following results:

Assays, Gold Ores, Kings Mt. Mine, Gaston County.

	(259)	(260)	(261)	(262)	(263)	(264)	(265)
Gold, per ton	$ 2.27	$ 3.10	$ 3.93	$ 4.96	$ 5.17	$ 6.21	$ 6.21
Silver, per ton	trace	.32	.23	trace	.62	trace	.77
	$ 2.27	$ 3.42	$ 4.16	$ 4.96	$ 5.79	$ 6.21	$ 6.98

	(266)	(267)	(268)	(269)
Gold, per ton	$ 12.40	$ 16.33	$ 39.27	$ 76.48
Silver, per ton	1.58	1.97	1.76	3.36
	$ 13.98	$ 18.30	$ 41.03	$ 79.84

Perhaps from $4 to $6 per ton will be nearer the present average value. The fineness of the gold is about 920. The concentrates are reported to run from $35 to $40 per ton.

There is still some placer ground to the east of the mine workings.

THE CROWDER'S MOUNTAIN (OR CALEDONIA) MINE is 4 miles east of the Catawba, and on the east side of Kings Mt., just over the gap between the two mountains. The country rocks are sericitic and chloritic schists, sometimes silicified, and often ferruginous, i. e. highly charged with magnetite or hematite. Certain narrow zones or belts of the schists are slightly mineralized with iron and copper pyrites; occasionally the width of the ore bearing

belt rises to 8 or 10 feet. The ores are commonly low in grade. The results from a number of assays are as follows:

Gold Ores, Caledonia Mine, Gaston County.

	(270)	(271)	(272)	(273)	(274)
Gold, per ton	$ 5.17	$ 1.03	$ 3.62	$ 9.10	$ 9.10
Siler, per ton	trace	trace	trace	trace	2.71
	$ 5.17	$ 1.03	$ 3.62	$ 9.10	$11.81
Copper, per cent			1 08%	0.18%	6.82%

THE PATTERSON MINE is ¼ mile northeast of the Caledonia, and has similar ores.

THE RHODES MINE is 18 miles southwest from Charlotte. The ore body is auriferous mica gneiss; it has been worked to a depth of 100 feet, and for a length of 300 feet. Galena is occasionally found.

THE MCLEAN (OR RUMFELDT) MINE is 15 to 16 miles southwest from Charlotte. It has been prospected probably for a length of 200 yards, and to a depth of 110 feet. The vein is filled with quartz carrying iron pyrites, and is from 1 to 6 feet in width. There is still some placer ground on the property.

THE DUFFIE MINE is 16 miles west of Charlotte on the Tuckaseegee road. The vein is from 2 to 10 feet wide, and has been worked to a depth of 110 feet, at which point a large body of low grade sulphurets was found. Some assays show the following values.

Assays, Gold Ores, Duffie Mine, Gaston County.

	(275)	(276)	(277)	(278)	(279)	(280)	(281)
Gold, per ton	$ 4.14	$ 5.17	$ 4.92	$ 10.33	$ 12 40	$ 13.43	$ 16.54
Silver, per ton	trace	.75	2.56	.91	.66	.65	.58
	$ 4.14	$ 5.92	$ 7.48	$ 11.24	$ 13.06	$ 14.08	$ 17.12

THE ROBINSON MINE adjoins the Duffie, and its ores are similar in character to those from that mine. Several assays of these ores give the following results:

Assays, Gold Ores, Robinson Mine, Gaston County.

	(282)	(283)	(284)
Gold, per ton	$ 3.45	$ 4.13	$ 9.31
Silver, per ton	trace	.13	.52
	$ 3.45	$ 4.26	$ 9.83

The Derr and the Rhyne mines are about 17 miles west of Charlotte.

THE BURRELL WELLS MINE is situated 3½ miles south of the Duffie; there are 4 veins; the deepest workings are less than 50 feet. Some spots of placer ground still exist, which are washed at intervals.

THE OLIVER MINE is situated 12 miles northwest of Charlotte, on the west side of the Catawba river. It is believed to have been among the earliest operated mines in the section, and there are traditions of work here, which was done prior to the Revolutionary war. It has been worked for a distance of 100 yards; sulphurets appeared at a depth of 75 feet, notably galena, which was rich in gold.

The Farrar Mine is ½ mile beyond the Oliver.

THE LONG CREEK MINE is situated 6 miles northwest of Dallas, the county seat. The property comprises about 600 acres. There are three veins, the Asbury, Dixon and McCarter Hill. The country schists strike N. 20° to 25° E., and dip generally 85° N. W. The quartz veins are approximately conformable to the schistosity. The Asbury vein has had some extraordinarily rich shoots of ore, which carried iron and copper pyrites, galena, zinc-blende, mispickel, and carbonate of bismuth. Its width was from 6 to 8 feet. It has been opened by two shafts, 45 feet apart, and worked to a depth of nearly 140 feet.

The Dixon vein has been extensively worked along the surface by pits, and two shallow shafts, 300 feet apart, from which drifts were run 79 feet south and 107 feet north. The thickness of the vein was a little over 3 feet.

The McCarter Hill vein has been entered by three shafts, within a distance of about 250 feet, and was stoped to a depth of 160 feet in the ore shoot, which pitches to the north, and increased longitudinally, until at the 140 foot level it had a length in the vein of more than 211 feet; the width ranges from 4 to 6 feet.

The last work at this mine was done on the McCarter Hill shoot in 1892. The assay value of the ore mined is stated to have been $8.00 per ton, of which about $3.00 was saved in the mill, and the concentrates ran $24.00 per ton.

LINCOLN COUNTY.

There is no mining work being done in Lincoln county, beyond desultory developments by small parties, though several mines have in the past been worked extensively; prominent among these latter are the Burton and the Hoke mines, near Lincolnton.

THE HOKE MINE has been sunk to a depth of 110 feet, and drifts run for some length.

THE GRAHAM MINE is situated about 4 miles northeast of Iron Station on the Carolina Central R. R. The vein is from 30 to 42 inches wide, and has been prospected by pits along nearly 100 feet of the outcrop. The ores contain some copper, and occasionally the material becomes a true copper ore.

CATAWBA COUNTY.

In Catawba county the Shuford mine is the only one where regular operations are carried on.

THE SHUFORD MINE is situated 4½ miles slightly south of east from Catawba Station on the Western North Carolina R. R.

The mining tract comprises 425 acres, but the workable portion of this tract embraces only 20 acres. This latter area is covered with auriferous quartz, and the soil is also auriferous. The underlying schists and gneisses are penetrated by seams of auriferous quartz, which run in every direction; but of veins, in any mining sense of that term, it may be doubted if there are any, although some of the seams, 12 inches or so in thickness, have considerable persistency in length and depth, and some general parallelism with the schistosity. The entire surface is "pay" material. The strike of the schists is N. 30° E., and the dip easterly. The mine is best adapted to a combination hydraulicking and milling process (Dahlonega method). The supply of water is always the most important consideration in work of this nature, and at the Shuford the supply is not large. The last work was directed to the exploration of the quartz seams in depth.

THE A. D. SHUFORD MINE, ¾ mile southeast from the above, is very similar in character.

Some work was done in the early part of 1895 at Maiden, about 5 miles south of Newton; and at several points near Newton, and at the McCorkle and the England mines. To these may be added

the Rufty mine, just outside of the limits of Catawba Station, and the Abernathy, 6 miles east of Maiden.

DAVIE COUNTY.

In the gneissoid rocks of Davie county there are several localities where gold has been mined at one time or another.

The Butler (or County Line) mine is 8 miles southeast of Mocksville. The ore body is reputed to have been large, though of low grade. Callahan Mountain was worked a generation ago, but with what results is unknown. The Isaac Allen mine is 1 mile northwest of Mocksville. There are deposits of gold in Clarksville township, 7½ miles northwest of Mocksville; also in Fulton township, 7 miles northeast.

YADKIN COUNTY.

THE DIXON MINE is situated 8 miles southeast of Yadkinville, the county seat. It was discovered in 1894. The following information is from Mr. Richard Eames, Jr., M. E., of Salisbury, N. C.: "The country rock is decomposed mica schist, sometimes chloritic, and intersected in places by diabase dikes. The vein is quartz, and on the outcrop shows a width of 4 feet. It has a steep dip to the northwest.

"A shaft has been sunk to a depth of 35 feet, at which point the vein holds its width of 4 feet. At this level drifts have been run 50 feet northeast, and 60 feet southwest. The vein from the shaft holds good each way for 25 or 30 feet, where it begins to be broken, and runs off into the laminae of the schists, making lenticular deposits and stringers. At places small stringers of kaolinitic matter intersect the vein at right angles, and are rich in gold for a distance of 2 feet from the vein, beyond which point they have no trace of gold. The value of the ore (quartz) is not uniform, as the following assays will show: outcrop at shaft, $36 per ton; 15 feet down, $10 per ton; 35 foot level, average, $7 per ton; rich specimen in 35 foot level, $40 per ton; poorest looking white quartz, $2.40. Milling results on small lots have given an average of $5 per ton.

"Some sulphurets of iron and copper are beginning to show in the ore."

There are no other important occurrences of gold in Yadkin county, so far as known at present.

CHAPTER VII.

THE SOUTH MOUNTAIN BELT AND ITS GOLD DEPOSI

GENERAL DESCRIPTION OF THE REGION.

The South Mountains form one of the prominent eastern s liers of the Blue Ridge, in Burke, McDowell and Rutherf counties. This region is the nucleus of one of the important b of auriferous rocks in the State, and comprises an area of so 250 to 300 square miles, extending from Morganton to near Ru erfordton, a distance of about 25 miles, with an average width 10 to 12 miles.

To the north of Morganton the more or less isolated occurren of gold in northern Burke, Caldwell and Wilkes counties on t east side of the Blue Ridge may be considered as belonging to t general belt. So also, to the south of Rutherfordton, the depos of Polk county, extending into South Carolina, will be includ here.

But the South Mountain region, proper, as above outlined, is t far the most important part of the belt, and will form the princip topic of the following descriptions and discussions. The accon panying contour map[1], Plate XII., shows the location of the mo important gravel deposits and mines in this region.

TOPOGRAPHIC FEATURES OF THE REGION.

The South Mountain range rises to a maximum altitude of 3,00 feet above sea level. The average elevation above the sea of th old base level, which is a prominent feature in this region, is 1,30 feet. This old plateau is dissected by the drainage, and gradually descends to 1,100 feet above sea level at the Catawba river, the main stream on the north. The country is drained on these north-

[1] From revised surveys of the U. S. Geological Survey, made in 1894, by Mr. Chas. E. Cooke, topographer. To such persons as may be particularly interested in this region, the Geological Survey will be glad to supply with a map, of larger scale, with 50 foot contours.

ern slopes by Silver and Muddy creeks, flowing into the Catawba river, and on the south by the First Broad and the Second Broad rivers.

HISTORICAL: THE BECHTLER COINAGE.

Gold was first discovered in Burke county in 1828 in the bed of Brindle creek, one of the small tributaries of Silver creek, which has its source in the South mountains.[1] Soon every stream in the neighborhood was prospected and panned with golden success. Large slave owners found a new and profitable use for their slaves, and many thousands of them were put to work in this new field. Placer mines were opened and operated on a large scale, though by primitive methods, the pan, rocker, long tom, and sluice box being the only implements at that time—and, indeed, these are still used in portions of this region to-day. Mining was at first confined to the stream gravels, which were generally rich. Later on the upper decomposed layer of the country rock and the more ancient placers, formed by secular disintegration and drift, were worked. A large amount of gold was produced in this way, but it is impossible to even approximate the amount, as absolutely no records were kept. The best authorities place the amount at between two and three million dollars.

There being but one U. S. mint established by the government at that time (at Philadelphia), and the means of transportation to that distance being attended with difficulty and great loss of time, the miners naturally looked about for some other means of converting their gold into a circulating medium on the spot. In 1831 a German, named Christian Bechtler, a jeweler by trade, living about 3 miles from Rutherfordton in Rutherford county, proposed to the miners that he would coin their gold for a small percentage. His proposition was accepted, and a large quantity of gold was coined in one, two and a-half, and five dollar pieces, with the name of "C. Bechtler, Rutherford County, N. C.," on one face, and on the reverse side the value, number of grains, and carats fine. The United States government instituted an investigation and upon finding that the assay value of the coins was always equal to, if not

[1] The story of the first discovery is given by Col. T. G. Walton, of Morganton, N. C., in an article which appeared in the *Morganton Herald* of March 15th, 1894.

somewhat greater than the denominational value, their circulation was not disturbed. The percentage paid by the bullion holders for coinage was 2½ per cent. Bechtler continued the mintage of these coins until his death in 1843, after which his nephew, C. Bechtler, Jr., continued until June, 1857. Sometimes as much as $4,000 to $5,000 were coined in a week, and for about 10 years the annual quantity was pretty equal. As no records of the quantities coined are in existence, it is impossible to even estimate the amounts of gold consumed here.[1]

These coins are now rare, and command a premium.

GENERAL GEOLOGIC AND PETROGRAPHIC NOTES.

The subaerial decay of the rocks is universal, and extends to a depth exceeding 100 feet in places; though the average thickness of the decomposed layer may be taken at about 50 feet. This fact will explain one of the great difficulties in studying the lithology, not only in this, but in every other portion of the State.

The rocks of the South Mountain Region are for the most part mica and hornblende gneisses and schists, having an eminently lenticular structure. They are often garnetiferous, and contain besides, many rare minerals, especially those of the rare earths, such as zircon, monazite, xenotime, fergusonite, etc. The primary origin of these gneisses is looked upon as being igneous granitic and dioritic rocks of Archean age, which have subsequently been rendered schistose by the action of various dynamic forces.

Owing to frost action the superficial layers of the country rock, especially along the slopes of ridges, have undoubtedly suffered motion and displacement[2]; in many instances, therefore, the surface dips of the schistose laminæ must be considered anomalous.

The general strike of the schistosity may be taken at N. 10° to 25° W., and the dip 20° to 35° N. E. This applies to the central part of the region. To the northwest of South Muddy Creek and Vein Mt., and in Caldwell, etc., counties, the strike is generally northeast, and the dip southeast.

[1] Report on the Survey of South Carolina for 1857, by O. M. Lieber, p. 135.
[2] On the Action of Frost in the Arrangement of Superficial Earthy Material. By W. C. Kerr. Am. Jour. Sci., 1881, Vol. 21, III., p. 125; and Ores of North Carolina, Appendix C, 1887, p. 329.

The mica gneisses are composed essentially of quartz, feldspar and mica. Both muscovite and biotite are present, the latter usually predominating. Phlogopite is of rare occurrence, as in the gneiss near the headwaters of South Muddy creek, at the old Bracket-town reservoir. All of the feldspars, from the potash to the lime-soda types, are present at various times. Plagioclase appears to predominate, especially in the more basic phases of the rock. Micro-perthitic intergrowths were noticed in many specimens, and microcline is common. Hornblende and pyroxene are altogether absent, or present only to small extent, in the acid mica gneisses, increasing in quantity and becoming essential minerals in the more basic hornblende gneisses. The hornblendes usually show greenish pleochroism, sometimes verging to brownish in color. The extinction angles are often very high, as in the hornblende gneiss from the Bracket-town shaft, McDowell county, where it reaches 30°; however, the cross-sections are usually good and characteristic. The pyroxenes are monoclinic, in most cases apparently augite. They are colorless and non-pleochroic.

The usual accessory constituents of these gneisses are magnetite, pyrite, titanic iron ore, garnet, zircon, monazite, and other rare minerals.

Alteration products are numerous. The micas are frequently altogether gone over into hydrous varieties and carbonates; and bleached biotites are common. The feldspars are always affected to some extent, being at times partially, and often completely, altered to kaolin or sericite. Propyllitic changes to epidote or zoisite are not uncommon. The ferro-magnesian minerals alter to chlorite and epidote. Zeolitic alterations are seldom met with.

These various alterations have in places proceeded to such an extent as to entirely obliterate the original character of the gneiss; and one of the best examples is met with in certain portions of the mine rock from the Bracket-town shaft, where the changes may be followed from fairly fresh specimens. This altered rock is light greenish in color and fine-grained in texture; macroscopically the constituent minerals are indistinguishable,

and the mass resembles felsite. Under the microscope, however, small fragments of unaltered feldspar are still to be seen, though the main portion is entirely decomposed to sericite and carbonates. In the hornblendic gneisses from the same mine the change of the ferro-magnesian minerals is to epidote and chlorite.

Such phenomena as secondary quartz and chlorite veinlets seem to point to a hydro-metamorphic action rather than a dynamic one. The effect of the latter force, however, is seen in the undulous extinction, bending, fracture, and other strain phenomena, exhibited by the minerals.

It is seldom that these rocks are porphyritic, as observed in a specimen collected from Brindle creek in Burke county, where the phenocrysts are plagioclase crystals up to ⅛ inch in diameter. More generally there is a homogeneity in the crystalline structure of the minerals, which is micro-granitic.

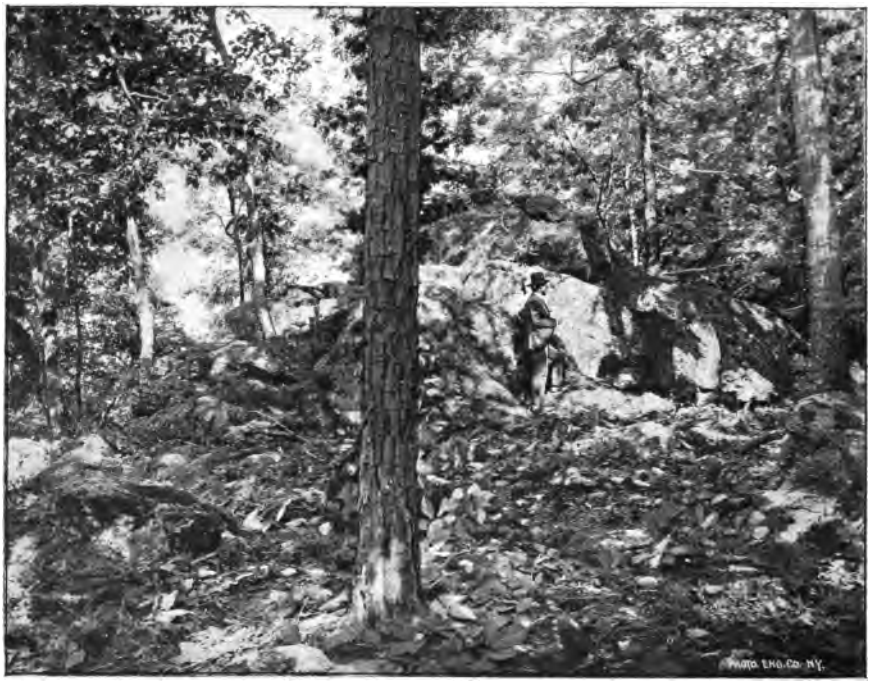
Relative to each other the mica and hornblende gneisses occur in adjacent lenticular banded masses, from a few inches to many feet in thickness; and it appears in instances that they pass into each other by insensible transition phases between these acid and basic types.

Pegmatites are of frequent occurrence in the gneiss, and they contain such fumarole minerals as tourmaline and beryl. Their structure is usually lenticular, like that of the enclosing gneisses. The feldspar is largely microcline, and the same alterations occur as noted above for the gneisses.

At Brown Mt., in the northern part of Burke county, the country rock is a massive granite. True granitic rocks, however, besides the pegmatites just mentioned, exist in the South Mountain region proper only as small dikes, and the general rock decomposition makes these difficult to distinguish. The most pronounced one was found at a point about ½ mile southwest of Capt. J. C. Mills' house on the Rutherfordton road. It is 3 inches wide, with a strike N. 20° W., and dip 80° N. E. It is a fine grained biotite granite, in which the feldspar is mainly microcline, with some orthoclase and micro-perthite, and the structure is micro-granitic. Similar dikes were observed at the

1

2



PYROXENE (1) AND AMPHIBOLITE (2) BLEBBS.—SOUTH MOUNTAINS.

Marion Bullion mine (Bracket-town), and Vein Mountain, in McDowell county.

Massive crystalline dioritic rocks are not uncommon in the South Mountain region, but whether they exist as dike formations or in larger bodies, it is as yet difficult to say. It appears probable that the former may be the case. They are usually fine grained, and composed of hornblende and a plagioclase feldspar, with very little if any quartz. The hornblendes show light to dark green, and at times blue to brown pleochroism. Among the accessory minerals apatite appears to be rather constant. The decomposition products are the usual ones, namely, sericite, kaolin, chlorite, epidote, etc.

Gabbroitic (augite-plagioclase) rocks are seldom met with, in fact the only occurrence noted was ½ mile south of the White House in the western part of Rutherford county.

There are no diabase dikes in the South Mountain region proper, but in the northern part of the general belt a heavy olivene-diabase dike extends persistently from near Hartland in Burke to the Baker mine in Caldwell county, the direction being about N. 20° W. At the latter point it is very wide and largely altered to serpentine.

Isolated, basic ferro-magnesian masses of pyroxenite and amphibolite occur sparingly throughout the South Mountain region as rounded inclusions in the gneiss. They are usually coarse crystalline and massive, devoid of schistosity. They vary in size from less than one to nearly one hundred feet in diameter. The schistose laminae of the gneisses are observed to bend around these inclusions, showing that they were formed before the force producing schistosity was exerted, which they resisted owing to their superior solidity and hardness. These masses are looked upon as basic segregations from the original igneous magma out of which the gneisses were formed. Their concentric structure becomes evident on weathering. So far as present observations go, their outcrop occupies a broken line, following the South Mountain chain in a direction approximately S. 60° W. Plate XIII shows above (1) a section of one of these smaller pyroxenite

blebs, partly altered to talc, to be seen in the bank by the road side, on Brindle ridge, Burke county. The lower half of this plate (2) is from a photograph of a much larger amphibolite bleb, which caps a low hill in the Turkey cove region, 1 mile north of Bracket-town, McDowell county.

The pyroxene in these rocks is monoclinic and non-pleochroic. In the amphibolites the hornblende shows light green pleochroism, though in one instance it was observed to be bluish green to yellowish brown. The extinction angles are sometimes very high, 24° and even 30°. The usual accessory minerals are magnetite and pyrite, which are sometimes present in considerable quantities. These rocks are universally altered to serpentine or talc, often completely so; and the serpentine possesses the characteristic fibrous grated structure, common to that formed from pyroxene or amphibole.

THE GOLD-BEARING QUARTZ VEINS.

The auriferous quartz veins of the South Mountain region are true fissure veins. Indeed the fissure system is the most regular, persistent and remarkable, from a point of almost absolute parallelism, in the State. The strike is N. 60° to 70° E., and the dip is from 70° to 80° N. W. The thickness of these veins varies from a mere knife edge to four feet. The great majority are from less than 1 to 3 inches thick, the larger ones (1 to 4 feet) being few and far between. They appear to lie in belts, composed of scores of small veins close together, and there seems to be some regularity in the spacing between the large veins. Faulting has been noticed in but few instances, and there the throw was only from ½ to 3 inches, always in a normal direction. At the Marion Bullion mine one of the veins is stated to be cut by a granitic dike, and thrown 4 feet to the south; but this could not be verified, and will require some further investigation. The veins vary in thickness, both on the strike and in depth; but they hold their parallelism so far as at present explored (the deepest shaft in the district is 126 feet); and there is no reason for supposing, as is the quite general belief of the natives, that they will come together in depth; in fact this would be unlikely and exceptional. The veins themselves,

it is true, are sometimes split by "horses" of the country rock, and at times have stringers running off from them at an angle, but individually they will preserve their parallelism in depth.

The ore or filling of the fissure veins is quartz, usually of a milky white color, generally saccharoidal, and seldom, if ever, vitreous or glassy. It is often stained brown and is cellular from decomposed sulphurets. The stained, saccharoidal quartz is usually the richest. Sulphurets occur below the water-level; these are pyrites, galena, chalcopyrite and sphalerite. All observations go to show that the vein matter is formed from ascending mineralized solutions. There is no evidence of replacement of the country rock by ore.

There is another system of quartz bodies, which lie interlaminated in the gneisses as small, discontinuous lenses. This quartz is glassy, contains some mica and feldspar, and is barren. It is locally known as "water-quartz."

DISTRIBUTION OF THE QUARTZ VEINS.

The quartz veins appear to be concentrated in aggregates along parallel belts or zones within the general ore bearing region. So far as can be asserted at present there are five (5) such principal belts. (This is subject to revision on further investigation.)

(1) The Morganton Belt; passing through Morganton, along Little Silver creek, and through the Neighbor's Place to near North Muddy creek.

(2) The Huntsville Belt, passing over the southern end of Huntsville mountain.

(3) The Pilot Mountain Belt, passing over Hall's Knob, White's Knob, Pilot Mountain, Bracket-town and Vein Mountain, to and beyond the Second Broad river.

(4) The Golden Valley Belt, passing across the upper end of the Golden Valley (valley of the First Broad river), and crossing Cane and Camp creeks to the Second Broad river.

(5) The Idler Mine Belt, about three miles north of Rutherfordton.

The maximum breadth, in a north and south direction, across the ore bearing formation as a whole is about seventeen (17) miles.

THE VALUE OF THE QUARTZ VEINS.

It is difficult to estimate with any degree of satisfaction the real value of these auriferous quartz vein deposits. Samples running several hundred dollars to the ton may be selected from the richer portions of the veins, but they are of course not representative. Other samples may show only a mere trace of gold and silver. From $5 to $20 per ton may be considered the more usual value of the average good grade of ore, dependent on the size of the vein. The wider veins are generally poorer in gold than the narrow ones. Wherever in this region there has been surface mining, many boulders are seen piled up which are evidently largely derived from veins of considerable size. Some assays of these large fragments, both from Brindletown and Golden Valley show only from $1.00 to $2.50 gold per ton. The fineness of the gold varies in different portions of the region[1]. Thus in the Brindletown district it is from 825 to 850; in McDowell county (Marion Bullion and Vein Mountain mines) from 780 to 800; in the Golden Valley, Rutherford county, 900; and in Polk county from 900 to 950.

METHOD OF WORKING THE QUARTZ VEIN DEPOSITS.

The great majority of these quartz veins are too small to be profitably worked individually, on any regular mining scale. The natives, both men and women, often hunt for and find the rich streaks of the small veins, which they mine in narrow open cuts, and extract the gold by crushing with another rock and panning. They frequently make from 75 cents to $1.50 per day in this way, of which they are supposed to pay a toll or royalty of ⅛ to the owners.

When the conformation of the ground admits, and the gulches are deep enough, the whole formation, including many of the small veins of quartz, may easily be undermined to a great depth,

[1]See article by Mr. G. B. Hanna, Engineering and Mining Journal, Sept. 18, 1886; also "The Ores of North Carolina," 1887, p. 235.

and the whole mass washed down into sluices, and thence to the mill for battery treatment and amalgamation of the auriferous quartz and hard masses, as is the practise in the Dahlonega district, Georgia.

At the Carolina Queen mine in Burke county there stands a five stamp mill, which at one time treated the ore from a great number of small veins (2 to 4 inches), obtained by hydraulicking and sluicing; this mill is now idle. Capt. J. C. Mills of Brindletown, Burke county, has treated the ore from a series of small veins similarly in a small stamp mill, as he reports, quite successfully; his mill was destroyed by fire a number of years ago and never rebuilt.

Some of the larger quartz veins have been opened by shafts and underground drifts, as for instance the "Nichols" vein (18 inches to 3 feet) at Vein Mountain in McDowell county. At the Idler mine in Rutherford county a vein 22 inches thick has been opened to a depth of probably 100 feet.

However, no vein mining of any magnitude has yet been done in the South Mountain region. It has been altogether of a desultory and spasmodic nature. In the whole region there are but two well appointed stamp mills, namely at the Vein Mountain, and the Carolina Queen mines. The Marion Bullion mine is equipped with a Huntington mill. No proper attempt has as yet been made to concentrate and treat the sulphurets. If, as reported, there are regular bodies of ore in the district, ranging from 18 inches to 3 feet in thickness, and running from $5 to $15 per ton, it seems difficult to understand why they should not be the basis of highly profitable mining enterprises.

THE PLACER DEPOSITS.

The Placer Deposits are of three classes: (1) The gravel beds of the streams and adjoining bottom lands, deposited by fluviatile action; (2) the gulch and hillside deposits, or the accumulations due to secular disintegration and motion, induced by frost action and gravity; (3) the upper decomposed layer of the country rock itself, the rotten rock in place.

In the first class the gravel is waterworn, rounded to sub-angular, and the deposits are from 1 to 2 feet in thickness. In the second class the gravel is usually quite angular, and the deposits are from a few inches to several feet in thickness. In the third class gravel is of course absent, the washable ground consisting of the upper decomposed layer in place, and the gold being derived directly from the partially disintegrated quartz veins.

The gravel is for the most part quartz, and among the beds are frequently found fragments of quartz with threads, plates, and crystals of native gold. These fragments, in many cases, evidently represent the entire thickness of the veins from which they came.

DISTRIBUTION OF THE PLACER DEPOSITS.

The principal stream deposits are those of Silver and South Muddy creeks and their numerous tributaries in Burke and McDowell counties; the First Broad river and its tributaries in Rutherford county, and the Second Broad river with its tributaries in McDowell and Rutherford counties. All of these streams have their source in the South mountains.

Most of the easily accessible stream deposits have been exhausted, and placer mining is being more strictly confined to the deep gravel channels, the gulch, and the decomposed country deposits. Their distribution is very general along the bottoms, highlands and ridges drained by the previously mentioned streams, and the principal centers of operation are at Brindletown, Bracket-town and Vein Mountain.

VALUE OF THE PLACER DEPOSITS.

As no records have ever been kept it is not possible to say what the ground will yield in gold to the cubic yard. It is naturally quite variable from a few cents to as high as $20 a cubic yard.[1] But it will run more generally from 4 to 50 cents.

The character of this gold is usually quite fine, although in certain localities some coarse gold is found; the largest nuggets have been found in a gulch on the western slope of

[1]On Capt. J. C. Mills' land at Brindletown, Burke county, a small area of ground was worked by tunneling on a gravel channel, and gave a daily yield of $160 to a volume of ground 5 by 7 by 6 feet (about 8 cubic yards), or $20 per cubic yard.

Huntsville mountain in McDowell county. One weighing five (5) pounds was washed out here.

METHODS OF WORKING THE PLACER DEPOSITS.

Simple sluicing is the common method employed in working these gravel deposits. Both ground sluices and wooden sluice boxes are used. The former are from 20 to 50 feet in length, 20 inches wide and from 12 to 20 inches deep; they are simply trenches cut into the soft bed rock, being unlined and unpaved. The wooden sluice boxes are from 8 to 15 feet in length, 12 to 20 inches in depth, 20 inches in width at the upper and 18 inches at the lower end, so as to fit into each other in case more than one is used. Each box is fitted with from one to two riffles. The grade of the sluices is from 1½ to 3 inches per 100 feet. The head box is fitted with a "grizzly," or perforated iron plate, on which the dirt and gravel to be washed are charged. The sluices are then worked over constantly with gravel forks or perforated shovels, and the larger rocks and pebbles are thrown out.

The native miners, working on their own account, known as "tributers," ordinarily use a single sluice box, which they move from place to place, working spasmodically as the inclination strikes them. They pay a toll of 16⅔ per cent. to the owners of the land. Fron 75 cents to $1.00 per day is considered good work by them.

At the larger mines hydraulicking is employed, under a pressure of from 50 to 200 feet, with 12 inch mains, reduced to a 1½ inch nozzle. The hydraulic elevator has also been used successfully in raising the gravel to fall line.

WATER SUPPLY FOR PLACER MINING.

The numerous mountain streams afford a fairly good, though not over abundant, amount of water for mining purposes. These streams are small in size but their flow is unfailing throughout all normal seasons, and they can be concentrated by ditch lines in sufficient volume for sluicing and hydraulicking purposes at many points. The chief impediment is in the loss of grade before the mining ground in the foot-hills and bottom-lands is reached, due to the deep and numerous indentations in the mountains. Reservoirs are sometimes necessary to store the water, in

order to obtain a requisite supply and head. It is impossible to water some portions of the hillside ground, except by pumping into reservoirs constructed above.

There are several long ditch lines, augmented by flumes, in the region; one of these is over 10 miles in length. The size of the ditches varies from 12 to 18 inches across the bottom, 20 to 30 inches across the top, and 12 to 20 inches in depth. The best grade is found to be from 1½ to 3 inches per 100 feet.

A considerable obstacle is often met with in the lack of sufficient dumping ground for the tailings, the grade of the streams being too small to carry off all of the sand. In some instances this could be overcome by freeing the larger streams from debris and drift wood, and in removing other natural impediments, such as shoals.

DESCRIPTION OF THE GOLD DEPOSITS AND MINES IN THE SOUTH MOUNTAIN REGION.

BURKE COUNTY.

THE HANCOCK MINE is a placer digging situated at the foot of the northeast slope of Hall's Knob. The thickness of the gravel bed is from 1 to 1½ feet, and that of the overlay averages 25 feet. Directly above the gravel is a peaty bed, containing blackened stems and trunks of pine wood.

A sluice, 2½ miles in length, brings the needed water supply, with a head of 40 to 60 feet. When last visited (in the summer of 1895) the mine was being worked on a small scale by tributers. The gravel was under fall which necessitated its being worked in pits, and raised by shovel into the sluice boxes. A rough estimate made of one of these pits shows that the yield was about 14 cents per cubic yard.

THE CAROLINA QUEEN MINE is situated on the northeastern slope of White's Knob, on Hall's creek. A series of small (1 to 3 inch) parallel veins has been hydraulicked and sluiced in the upper decomposed layer, over a width of about 300 feet of ground. One of these veins (the so-called "Fisher" vein) has

PLACER DEPOSITS, FOOT OF SOUTH MOUNTAINS ON THE NORTH. HANCOCK MINE.

been explored in a trench ¼ mile long to a depth of 50 feet. The material was sluiced to a 5 stamp mill close by, where it was milled. The ditch lines aggregate 5 to 6 miles in length. The strike of the quartz veins is N. 50° to 60° E., and the dip is 75° to 80° N. W. The schistosity of the gneiss strikes N. 20° W. and dips 20° N. E. The mine is now idle. The placer ground on Hall's creek has been practically exhausted.

The Hodge Property is situated on Silver creek, about 3½ miles north of Pilot mountain. It comprises considerable placer ground along the creek and adjoining bottoms, at present filled with sand and not workable, without the production of some artificial fall. During the summer of 1894 a number of prospect pits were sunk on the adjoining hills in garnetiferous, sillimanite schist, containing considerable secondary quartz, which was mistaken for gold ore. Several samples, some of which contained pyrite, were collected here by the Survey, assays[1] of which showed no more than the merest trace of gold, and a maximum of 1 ounce in silver. Further search for gold in this ground is ill advised.

The J. C. Mills Property at Brindletown covers a large territory on both sides of Silver creek, including the eastern half of Pilot mountain.

A vast amount of gold has been obtained here since the first discovery in 1828, and much of the gravel has been washed over three times with good results. Considerable work has been done on the hillside and gulch deposits, and much of this ground is still virgin and valuable. Some of the richest channels have yielded the exceptional output of $20 per cubic yard. (See p. 162.)

From Pilot mountain and along its lower slopes a number of gravel channels radiate in all directions, some of which have been located and worked as high as water could be obtainded, such as the White Bank and Magazine mines. But a large amount of virgin ground still remains here that has not been worked for lack of water. Pilot mountain is an entirely isolated peak, and the only means of obtaining water sufficiently high

[1] Assays Nos. 251, 252, 253 of the Survey laboratory series, by Dr. Chas. Baskerville for the N. C. Geological Survey.

for mining puposes, would be either by pumping into reservoirs, or by means of a siphon line (about 1 mile in length) from "Hard Bargain" gap, to which water could be brought from the headwaters of the First Broad river, in a ditch line from 15 to 20 miles in length.

The total length of the several ditch lines on this property is about 20 miles, with 4800 feet of fluming. The longest flume is 600 feet, and the highest trestle 28 feet. The grade is 1½ to 3 inches in 100 feet. The ditches are 18 inches deep by 24 inches wide. Cost of ditching is 25 cents per rod. The flumes are 18 inches wide by 12 inches deep. In places where the grade is less than the above mentioned the ditches and flumes are made wider. The head obtained is from 60 to 200 feet.

Along the waters of Brindle creek the quartz veins in the decomposed country have been hydraulicked and sluiced, but no regular vein mining has been attempted. The veins are small, with few exceptions, (one vein on the Mill's place is from 12 to 18 inches thick, but it is almost barren in gold, at least where exposed). They strike and dip in the normal direction. The strike of the crystalline schists averages N. 20° W., dip 20° N. E.

Altogether this has been the most extensively worked tract in the South Mountain region. During the past year the Piedmont Mineral Company, limited, erected a new hydraulicking plant with gravel elevators, and regular operations are probably in progress by this time.

McDOWELL COUNTY.

The Marion Bullion Company owns an extensive mining tract, situated at Bracket-town, in the valley of the headwaters of South Muddy creek. The accessible placer ground has been worked to the head of the present ditch line. By building new reservoirs and ditches at a greater elevation a considerable area of virgin ground might be made available here; and by removing several shoals in Muddy creek the fall of the same might be lowered sufficiently to work the stream and adjoining bottom gravels, heretofore inaccessible.

It is not possible to state any definite value of these deposits. In a general way, the hillside and gulch ground ranges from 4 to 50 cents per cubic yard, while the gravel of the bottom land will run as high as $1.00 per cubic yard.

A number of small quartz veins have been prospected on the property. The most extensive explorations in this direction were made during the past few years by sinking a vertical shaft (7 by 11 feet cross-section) to a depth of 126 feet on a series of six narrow quartz veins, lying close together.

The country rock is biotite gneiss striking N. 10° W., and dipping 15° to 20° N. E. It is lenticular in structure, and encloses lenses of a highly altered greenish sericite gneiss.

Near the outcrop the quartz veins vary from 1 to 6 inches in thickness, and are from 1 to 3 feet apart; they are parallel and strike N. 68° E., dipping from 63° to 70° N. W. The prime object of the shaft was to ascertain whether these veins would grow larger and come together in depth, according to a popular but fallacious belief; instead of this, they are found to pinch out to less than one inch at the bottom of the shaft, and to maintain their distance apart. Two small normal faults were observed in the veins, of as much as ½ inch throw. The quartz is saccharoidal, and mineralized with galena, blende, chalcopyrite and some pyrite. The wall rock itself, though not highly so, is impregnated with pyrite to a greater extent than the vein matter.

The quartz alone from these veins gives assay values ranging from $4.00 to $20.00 per ton in gold and silver. At the depth of 115 feet a sample of the entire shaft material, vein quartz and wall rock, assayed $4.80[1]. A test mill run was made in September, 1894, in a Huntington mill and two Frue vanners, situated on the property. Fifty-four tons of quartz and rock were treated; of this amount one-fourth was quartz from the 50 foot level in the shaft, three tons were float quartz, collected in hydraulicking on another part of the property, and the remainder was rock and vein quartz from the shaft. The result was 71 dwts. of free gold, caught as amalgam in the body of the mill beneath the stationary

[1] Assay No. 235 (of the Survey laboratory series) by Dr. Chas. Baskerville, assistant chemist, N. C. Geological Survey.

grinding plate, and on the Hungarian riffles; practically no gold was obtained from the silvered copper plates. The concentrates from the two Frue vanners amounted to 2 tons, which were so dirty that they were run over and reduced to 260 pounds. The tailings on this second run showed enormous loss, especially in galena and floured amalgam, due either to the inefficiency of the vanner or more probably to inexperience in operating the same. An assay[1] of the final concentrates showed only $7.88 per ton, and a sample of the tailings gave $2.63[2]. This is certainly discouraging. If further and more extended exploration can show that the entire rock mass, at least over a considerable width, in the bottom of the shaft and in the cross cuts, will average from $3.50 to $4.50 per ton, then, by careful and intelligent management the mine might be a profitable low grade proposition; but certainly no dependence can ever be placed on the small veins alone.

THE VEIN MOUNTAIN PROPERTY comprises a large tract of land extending from Vein Mt. on the Second Broad river in a northeasterly direction to Huntsville Mt., a distance of about 4 miles. The gulch deposits of Vein mountain have been hydraulicked to points as high as water was accessible by the ditch line, 16 miles in length. A careful and extensive examination[3] of the gravel still left in the gulches shows a range in value from 15½ cents to $1.28 per square yard of bed rock on which it lies; and a similar examination of the soil of Vein mountain shows from 5½ to 24 cents per square yard of bed rock. On the Vein mountain end of the tract there appear to be 37 acres of superior gravel, ranging from 39½ to 55 cents, and 169 acres ranging from 15½ to 19 cents per square yard of bed.

The gulch deposits in the western slope of Huntsville mountain have been worked to some extent, and yielded a considerable amount of coarse gold. In a narrow mud seam at the head of one of these gulches a nugget weighing 5 pounds was found.

The crystalline schists at Vein mountain have a general strike of N. 10° to 15° W., dipping 30° N. E. A number of small

[1] By Dr. Chas. Baskerville, assistant chemist of the N. C. Geological Survey. Assay No. 254 of the Survey laboratory series.
[2] By Dr. C. Baskerville. Assay No. 255 of the Survey laboratory series.
[3] By Mr. G. B. Hanna.

pegmatitic (?) dikes cut the country at various angles, with unmistakable signs of faulting.

A series of as many as thirty-three (33) parallel auriferous quartz veins crosses at Vein mountain in a belt not over ¼ mile wide. The principal and largest one of these is the "Nichols" vein, which has been prospected in four shafts, the deepest one being 117 feet. Shaft No. 1 is 1200 feet east of No. 4, and 100 feet above it in elevation. The strike of this vein is about N. 80° E., and its dip varies from 75° N. W. to nearly vertical. Its thickness is reported to vary from a few inches to three (3) feet, the usual portion of the vein worked being from 15 to 30 inches. Below the water level the quartz is mineralized with sulphurets, chiefly pyrite and some chalcopyrite, galena and blende. A number of assays show the following variation in the value of the quartz.:

Assays, Gold Ores, Nichols Vein, Vein Mountain.

	(285)	(286)	(287)	(288)	(289)	(290)	(291)
Gold (per ton)	$2.58	$4.17	$6.20	$10.33	$13.43	$12.40	$70.28
Silver " "	trace.	trace.	trace.	trace.	trace.	1.51	5.43
	$2.58	$4 17	$6.20	$10 33	$13.43	$13.91	$75.71

According to the statement of the present superintendent, Mr. B. G. Gaden, mill runs of the ore have averaged $15 and $17 per ton. If any such values can be obtained in quantity, there is no reason why the mine should not be operated at a great profit, and the present inactivity is difficult to explain. There is a ten stamp mill in good condition, without any concentration machinery, on the property.

RUTHERFORD COUNTY.

THE ALTA (MONARCH OR IDLER) MINE is situated about 5 miles north of Rutherfordton, on the divide between Cathey's creek and the second Broad river.

As many as thirteen parallel quartz veins have been explored here, within a distance of ½ mile across the strike. The four larger veins are known as the Monarch, Alta, Carson, and Glendale. These various veins have been worked since 1845 by numerous shallow open cuts, pits, and shafts, down to the water

level, and the ore was milled in arrastras. The last work was done on the Alta vein some 2 or 3 years ago. A shaft was sunk here to a depth of 105 feet, but the workings were inaccessible when visited, and the following notes are taken from several outside reports on the property. The strike of the Alta vein is approximately N. 65° E. The thickness of the vein varies from 10 to 22, averaging perhaps 15 inches. The quartz is of a milky variety, mineralized with pyrite and some chalcopyrite. The ore contains from 1 to 20 per cent. of sulphurets, averaging about 5 per cent. One statement gives its average yield in free gold, by mill test, at $10 per ton; another gives $30; and the value of the concentrates has been stated to be $100 per ton. There is a 5 stamp mill, in very poor condition, on the property.

The Ellwood Mine is situated 3 miles N. 20° E. from Rutherfordton and 1½ miles southwest from the Alta mine, on the waters of Cathey creek.

A series of five parallel quartz veins, 100 feet and more apart, was first opened here some 50 years ago. The last work was done in 1893, but barely paid expenses as stated by the present owner, a fact which it is difficult to reconcile with the subsequent statements. At no point have the veins been worked below water level. The country gneisses strike N. 60° W., and dip 25° N. E. The veins strike N. 50° E., and dip 80° N. W. The thickness of the larger veins varies from 10 to 15 inches. The ore is reported to run $5 to $7 per ton in free gold. It shows some sulphurets, pyrite and chalcopyrite. The sulphuretted ore is reported to run $20 per ton.

The Leeds Mine is situated on a quartz vein parallel to and 100 feet north of the Ellwood veins. It has been abandoned many years and is inaccessible.

CONCLUSIONS AND RECOMMENDATIONS AS TO MINING OPERATIONS IN THE SOUTH MT. REGION.

AREAS STILL AVAILABLE FOR MINING.

In the South Mountain region there are considerable areas of placer mining ground still worthy of attention. The operations

of the past, when little capital and machinery were employed, were necessarily confined to such deposits as lay near water, or to which water could easily be brought. There is still a considerable amount of gold in the beds which remained untouched, as well as in those which have been carelessly or or rudely worked over—some of them more than once. Indeed, some of the richest of these deposits have remained unworked on account of the difficulty of bringing a supply of water to their level, being situated considerably above the neighboring streams, or the higher slopes and benches along the foot hills of the mountains. Attention should be directed to operations on a larger and more systematic scale, than has heretofore been generally in vogue in the district; and by this means the ground can also be more thoroughly prospected and the workable channels more accurately located.

IMPROVEMENT IN WORKING METHODS.

The methods of working are susceptible of improvement. Where the gravel is below the grade of the water courses, and this is so frequently the case in the district, the more general application of the hydraulic elevator is advocated.

TREATMENT OF CLAY BALLS—"SLUICE ROBBERS."

A very frequent source of loss and annoyance is occasioned by the formation of clay balls in the sluices, which in rolling pick up fine particles of gold and carry them off. These are the so-called "sluice robbers." The clay is stiff and greasy, and it is almost impossible to break it up into fine mud before it reaches the sluices. In many instances the miners should, by more careful attention with the gravel fork, prevent its entrance into the head of the sluices. Should it be impossible, with all careful precautions, to avoid the formation of these clay balls, it is suggested that they be collected at the end of the sluice, and, either dried and afterwards pulverized and washed, or treated directly in some sort of puddling boxes.

IMPROVEMENT OF WATER CONDUITS.

Concerning the water conduits, considerable distance and grade can in instances be saved by the construction of closed pipe lines

or "siphons" across the gulches and hollows, where trestling and fluming are impracticable. The ditch lines should also be more carefully surveyed and located; thus on the Marion Bullion Company's property the present ditch line could be raised perhaps some 50 feet, which would water new mining ground for many years to come. The construction of better reservoirs for impounding the water, where necessary, should also be looked to.

DISPOSITION OF THE TAILINGS.

The question of attaining an adequate grade for carrying off the tailings is of paramount importance. It is often possible to work a hydraulic mine to advantage, but the fall of the stream below may be insufficient for carrying off the debris or tailings, which are almost wholly fine sand and mud.

In instances this may be overcome by straightening the stream, cutting off bends by canals, and by removing such natural obstructions as shoals. By thus cleaning out a stream, portions of its bed gravel may also be made available for washing. Thus a crude survey of the upper part of South Muddy creek has shown that by removing the Taylor shoal the surface of the stream above can be lowered so as to reach the bed rock on the Marion Bullion Company's land.

Another important matter is the disposition of the tailings. Unless there be sufficient current and volume of water the stream will become filled with fine sand, and eventually overflow its banks, depositing the sand and rendering the adjoining bottom lands waste. In the South Mountain region this is very apt to be the case, and as the bottoms are considered the most valuable part of the farming land, the consequence of impairing them may result in serious litigation, as has been the case in California.

The only means of averting this trouble is to devise some artificial dumping ground for the tailings, such as may be attained by the construction of canals and dams.

MONAZITE DEPOSITS IN THIS REGION.

Attention is called to the value of the mineral monazite, which has of late years come into demand for the manufacture of the

incandescent light mantles, as an important product in many of the gold placer mines of this region.

DEEP MINING IN THE SOUTH MOUNTAIN REGION.

Referring to the upper decomposed rock layer with its innumerable auriferous quartz veinlets, a combination sluice and mill treatment by the Georgia method may in many cases be applicable.

But little encouragement can be given to deep mining in the South Mountain region. It is of course impracticable to mine the small quartz veins, so abundant in the region, to any depth. They are too narrow, and not sufficiently rich in gold; nor will they unite in depth, as is the prevalent belief of many. There are a few larger veins, such as the Nichols and the Alta, which would apparently warrant further exploitation. They should be opened below the water level in depth, and for some distance along the strike so as to expose a fair amount and the various grades of ore in sight. Cross-cuts should also be driven so as to determine the proximity of other veins of importance, if there be any. If then, careful and impartial samples be taken for assay, or better still, mill tests be made, the probable value of the mine can soon be established. According to outside reports there are ores here which rank in quality with those of successful operating mines elsewhere. This, however, needs verification; the Survey can make no definite statements in the light of present conditions. Finally, if upon proper investigation, such mines are really proven to contain workable ores, they should be operated under proper business management and technical skill, and with sufficient equipment and working capital to insure their success. The stamp mill, with concentration and chlorination works should be tenaciously adhered to.

DESCRIPTION OF MINES IN OTHER PORTIONS OF THE GENERAL SOUTH MT. BELT.

POLK COUNTY.

The Polk county deposits, some 25 miles southwest, appear to be an extension of the deposits of the South Mountain area. The

gravel of this county is much like that of Burke, McDowell and Rutherford, but the region is lacking in the natural advantages, which, in these latter counties constitute so important a feature in working the deposits; and from this defect, chiefly, the mining has languished. In this county gold occurs in both placers and veins—strikingly similar to the placers and veins in the larger areas just discussed. At present the localities are hardly more than names, for the desultory work carried on cannot be called mining. The better known localities are the Pattie Abrams, Wetherbee, Red Springs, Tom Arms, Splawn, Ponder, Riding, L. A. Mills, Carpenter, Hamilton, Neal, MacIntire, Double Branch and Prince. These all had a good reputation in the palmy days of mining, while the deposits contiguous to water lasted, but at present none can be worked on a large scale without a larger supply of water than can be obtained from the vicinity of the mines.

The eastern part of this county is comparatively flat, and a sufficient supply of water with a good head could be obtained only from the North Pacolet river in the southwest part of the county, by a ditch 20 miles long.

THE PRINCE MINE is exclusively a placer working, and it is not known that veins exist. The better quality of quartz found in the top dirt shows an ounce of gold per ton, by assay.

THE RED SPRING MINE has 3 veins; and the Splawn mine has a massive vein of low grade quartz.

On the DOUBLE BRANCH PROPERTY, some assays of a narrow quartz vein (1 to 3 inches in width) show enormous variations:

Assays, Gold Quartz, Double Branch Mine, Polk County.

	(292)	(293)	(294)	(295)
Gold, per ton	$2.07	$23.77	$465.07	$9.30
Silver, " "	trace	trace	1.43	trace.
	$ 2.07	$23.77	$466.50	$ 9.30

292. Barren looking quartz. 293. Lively quartz, with string of brown ore, sampled across vein, 2½ inches.

294. Sampled across vein, 1 inch (Brown Ore). 295. Compact pyrites, covered with coating of brown oxide.

At the SMITH MINE, ½ mile east of the above, there are similar rich narrow veins, the occurrence being strikingly like that at the Carolina Queen mine in Burke county.

BURKE COUNTY.

THE BROWN MOUNTAIN MINE is situated 13 miles north of Morganton on Caney branch, a tributary of Upper creek. The main mass of Brown Mt. is made of granite, while its western slope, towards Upper creek, is composed of chloritic schists. The mine openings, which amount simply to prospects, consist of two shafts and one small open cut. Shaft No. 1 is 20 feet deep, in coarse grained granite. The quartz appears to lie in irregular stringers in the granite, varying from 1 to 6 inches in thickness; sulphurets occur sparingly. An open cut, 6 by 15 feet by 5 feet deep, is situated 75 feet southeast of shaft No. 1, and exposes a ledge of granular, milky quartz, 7 feet wide, intercalated with chloritic schist. It has a barren appearance. The dip is 75° S. E.

Shaft No. 2 is situated ¼ mile west of No. 1. It is 25 feet deep, and exposes two bodies of chloritic schist, each about 2 feet in thickness, lying in decomposed granite, and striking N. 60° W., with a dip of 75° S. W. The most southwesterly one of these is well impregnated with quartz lenses and stringers, and presumably constitutes the ore.

Gen. R. F. Hoke, of Raleigh, N. C., the owner of the property, furnished an assay of a sample, taken from "The shaft on the top of the hill", (presumably shaft No. 2), which showed $15.42 per ton (gold $12.40, silver $3.02). A sample taken from the ore dump at the mouth of this shaft by the present survey, showed only a trace of gold and one ounce of silver.[1]

More extended prospecting is to be recommended here before the value of the deposits can be determined. The bed of Caney branch was washed for gold in former years, up to a point about opposite to shaft No. 1, and is reported to have yielded well.

CALDWELL COUNTY.

The Miller, Scott Hill, Pax Hill and Baker mines are situated on the waters of Johns river near the southern boundary line of the county.

[1]Assay sample No. 268. Dr. Chas. Baskerville, Chemist.

Their respective positions are better shown in the accompanying topographic sketch, fig. 15, taken from the Morganton sheet of the United States Geological Survey. These mines are located on parallel veins, in each instance in close proximity to a wide diabase dike, which strikes across the mica gneiss country in a direction about N. 20° W. None of the mines have been operated for some years past, and they are now entirely inaccessible, wherefore but little can be said of them.

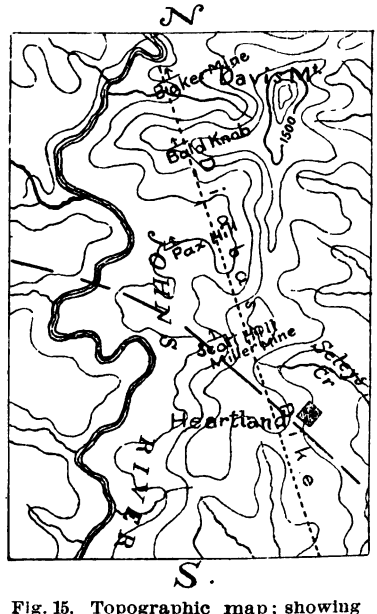


Fig. 15. Topographic map; showing location of Miller, Scott Hill, Pax Hill, and Baker Mines. Scale 1 inch—2 miles. Contour Interval 100 feet.

The Miller and Scott Hill Mines adjoin each other, and are situated on the waters of Seley's creek, 1½ miles northwest of Hartland P. O.

The branches and adjoining hill ground have been worked for placer gold. A series of parallel veins have been explored by a great number of cuts, tunnels and shallow shafts. Judging from the course of these old diggings the strike of the veins is N. 50° —60° E., with a dip to the northwest. The float quartz which was observed here is of a white vitreous variety, and the largest pieces are 12 inches in thickness.

A five stamp mill was at one time in operation at the Miller mine, but it is now converted into a distillery. The diabase dike passes near this building and strikes N. 20° W.; it is probably over 100 feet wide.

The Pax Hill Mine is 1 mile northwest of the Miller and Scott Hill mines. Some placer work has been done here. Three main veins have been opened, situated about 30 yards apart, and striking N. 60° E. They are reported to be respectively 8, 10 and 12 inches wide.

THE BAKER MINE has been more extensively worked than any of the above mentioned. It is situated on the western slope of Davis mountain, near the river.

The country schists and gneisses strike northeast, and dip southeastward. The diabase dike at this point is very wide (over 75 feet), and is largely altered to serpentine, intersected by narrow veinlets of chrysotile. The quartz veins are in the schist and run northwest and southeast; it is not certainly known whether they continue into and across the serpentine.

There are four principal veins; the more northerly is the Braswell, which has a large boldly projecting outcrop, but has never been much examined. It strikes N. 35° W., and dips about 60° N. E.; its width is from 2 to 5 feet. The Goley Ann vein bears N. 39° W., and dips 70° N. E.; it is narrow at the surface.

The Shaft vein is next, to the southwest; it strikes N. 45° W., and dips 66° to 75° N. E. It is from 20 to 24 inches in width, and has been opened at points 200 yards apart. The quartz veinstone carries scattered galenite and associated minerals.

The Cabin vein is still further south, and was worked at points 100 yards apart; it strikes N. 35° W., dips 60° N. E., and is 20 inches wide. The veinstone is quartz with ferruginous matter and galenite in considerable quantities. The galenite is highly auriferous as well as argentiferous; some assays[1] of the pure material show:

Assays, Ores from Shaft Vein and Cabin Vein, Baker Mine, Caldwell Co.

	Shaft Vein. (296)	Cabin Vein. (297)
Gold, per ton	$ 87.31	$ 34.00
Silver, per ton	21.24	87.89
	$108.55	$121.89
Lead, per cent	84%	83 5%

The quartz of all the veins, aside from the galenite, carries gold. The surface and particularly the gulches and streams were originally rich in placer gold.

Adjoining the Baker is the *Old Miller Mine*, a former placer digging. About ½ mile south of the Baker is the *Bald Knob Mine*, where the vein is reported to have a thickness of 4 feet. The *Francis Mine* is also near here.

[1] By J. G. Ellery.

It is a noteworthy fact that all of the above described mines hold a positive relation to the diabase dike which accompanies them, and which has undoubtedly facilitated the activity and ascension of the ore bearing solutions.

THE BEE MOUNTAIN MINE is situated about 4 miles (air line) N. 80° W. from Lenoir, on the northeast slope of Bee mountain. The openings consist of two shallow prospect shafts and a tunnel. The country rock is garnetiferous mica gneiss and pegmatite, which strikes N. 60° E., and dips 45° S. E.

Shaft No. 1 is 70 feet deep; now filled with water. The dump shows no ore. Shaft No. 2 is about 30 feet deep, and shows a 4 foot quartz vein on the outcrop, striking N. 75° E. Much of the quartz is cellular and stained brown, and is mineralized with zinc blende and some galena and chalcopyrite.

The tunnel is situated lower down on the slope of the hill, and is 100 feet long in a direction N. 20° W.; it exposes nothing of interest, as it does not cut the vein.

WILKES COUNTY.

At FLINT KNOB in the southwestern part of the county, 6 miles east of Deep gap in the Blue Ridge, argentiferous lead ore is found. The property is situated on a mountain spur that shoots off from the Blue Ridge at intervals, and extends with gradually diminishing sharpness of outline and altitude to the Yadkin river. This particular spur is called Laurel Spur, and further down, Flint Knob, from the abundance of quartz which covers it. The earliest settlers were aware that lead was found there; extended explorations were undertaken some 60 years ago by Dr. McKenzie, and later by Gen. S. F. Patterson. The galenite is scattered more or less sparingly in a quartz gangue. Assays by Adelberg and Raymond showed samples to contain:

Assays, Ore and Concentrates, Flint Knob, Wilkes County.

Ore. (298).		Concentrates. (299).	
Lead	19.5 per cent.	Gold, per ton	$ 81.57
		Silver, per ton	7.33
			$88.90

Five tons of ore made one ton of concentrates.

When visited in the fall of 18
several quartz veins, carrying
were seen; but at no point h
determine the possible value of t
is garnetiferous gneiss.

In the northern part of the c
Hill to Wilkesboro crosses Roa
from the river sands.

Another locality is near Trap
Blue Ridge at Bryan's gap, w
been traced for nearly three n
the schists, and ranges from 3
pyrites with a small proportio
ally auriferous. A series of as

Assays, Gold Ores, Br

	(300)	(301)
Gold, per ton	$1.57	$1.55
Silver, per ton	.84	1.01
	$ 2.41	$ 2.56

CHAPTER VIII.

THE GOLD DEPOSITS WEST OF THE BLUE RIDGE.

In the region west of the Blue Ridge are several gold mining localities, some of which have attracted attention, and have been the site of more or less productive work.

It is highly probable that the schists in the mountain section are universally slightly auriferous, the gold being set free by weathering, and after erosion, being concentrated in favored sinks.

In truth gold has been found in most of the mountain counties, and these sporadic occurrences have given rise to numerous, but short lived, mining excitements.

From a large number of assays of material from all parts of the Blue Ridge counties it may be said that gold is never absent whenever the material possesses the least dissemination of any variety of sulphurets, and generally in quantities somewhat larger than traces, though not often constituting workable ores. The presence of galenite usually adds to the silver contents.

In Ashe and Alleghany counties some of the copper ores contain a small proportion of gold and silver, though, with the exception of the Copper Knob mine, they are not regarded as possible producers of the precious metals.

ASHE COUNTY.

THE COPPER KNOB (OR GAP CREEK) MINE is situated in the southern part of the county, on the waters of New river. There are three quartz veins, though only one of them has been worked to any extent. It lies in a large body of hornblende schist, but the prevalent country rock of the section is gray gneiss, with a strike N. 60° E., and a dip 40° S. E. The strike of the fissure is N. 35° W., and the dip 45° N. E., though neither dip nor strike is uniform.

The vein-stone is quartz; in the upper part it was accompanied by a selvage of iron peroxide, extraordinarily rich in gold. The mineral seam occupied the centre of the quartz fissure, and varied from 4 to 6 inches in thickness. In the 60 foot level the vein varies from 14 inches to 3 feet. On the northwest course, along this level, the vein contains copper ores for 53 feet, when the quartz becomes slightly changed and carries native gold, with brown oxide of iron, for about 36 feet. Here the bearing is changed to N. 43° W. The vein appears to be more mineralized on the northwest than on the southeast side of the workings, which run into the Knob. The ore is complex: vitreous copper ore, malachite, chryscolla, a very little chalcopyrite, brown ore, etc. Iron pyrite is almost wanting. The ore seam increased somewhat in width as greater depth was gained. The shaft was sunk to a depth of 60 feet with satisfactory results, and subsequently deepened (as reported) to 140 feet. At this stage the mine became the prey of a company of speculators. The concurrent testimony of many persons cognizant of the last work is that the resources of the mine continued good as far as the explorations extended.

The nature of some of the ore is shown in the following assays:

Assays, Gold and Copper Ores, Copper Knob Mine, Ashe County.

	(307)	(308)	(309)	(310)
Gold, per ton	$ 8.62	$ 34.79	$ 57.36	$ 77.51
Silver, " "	2.26	25.50	14.53	45.68
	$ 10.88	$ 60.29	$ 71.89	$ 123.19
Copper, per cent			23.83%	37.44%

In WATAUGA COUNTY a limited area of gold gravel is found on Howard's creek, which was worked on a small scale before the war. Gold is also found in this county at Hardin's, one mile north of Boone.

In BUNCOMBE COUNTY, indications of gold have been found on Cane creek.

HENDERSON COUNTY.

THE BOYLSTON MINE is situated on the southeastern slope of Forge mountain, on the waters of Boylston creek, 22 miles south of Asheville, and 12 miles west of Hendersonville. It is the

property of the Boylston Mining Company, and embraces an area of some 618 acres. The mine is equipped with a ten stamp mill, Frue vanner, boiler, engine, etc., all of which are now in serious disrepair.

The topography of the region is shown in the accompanying sketch map (Fig. 15), redrawn from the Pisgah topographic atlas sheet of the United States Geological Survey.

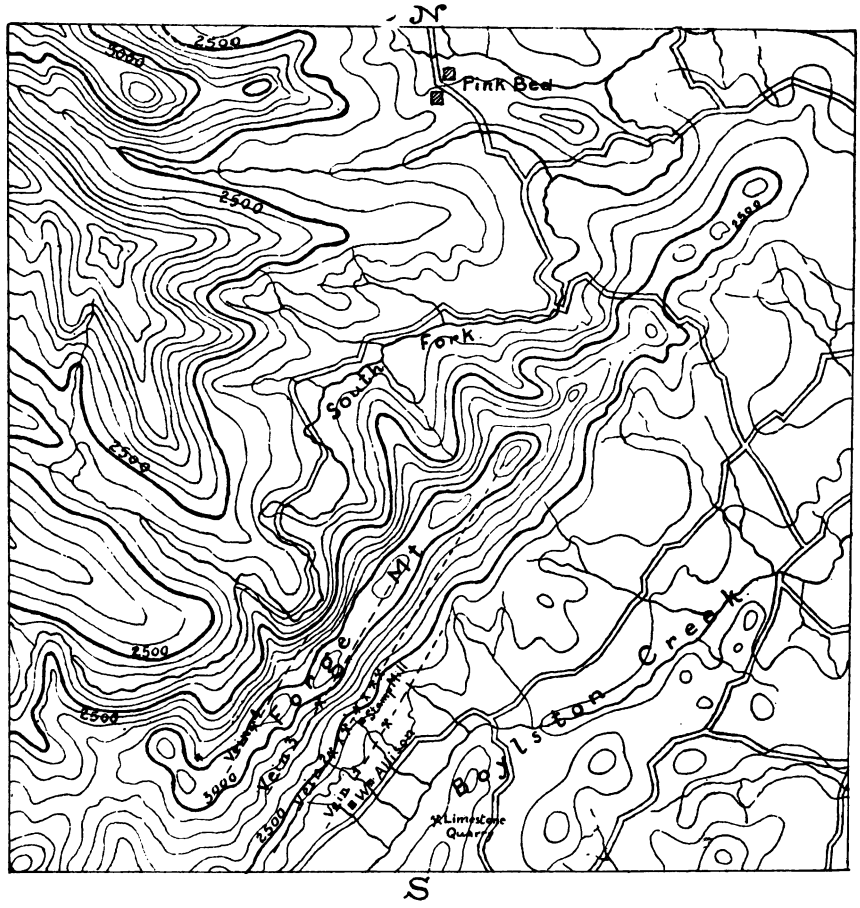


Fig. 16. Topographic map, showing location of the Boylston veins on Forge mountain, Henderson County, N. C.
Scale: 1 inch 1 mile; contour interval 100 feet.

The general elevation of the valley of Boylston creek is 2200

feet above the sea level. The crest of Forge mountain rises 900 feet above the valley, or 3100 feet above sea level.

Forge mountain is made up of fine grained mica and hornblende gneisses and schists, in part much crumpled. The general strike of the schistosity is N. 20° to 30° E. The dip is to the northwest; near the surface the inclination is about 35°, gradually increasing to 50° and 60° within a short distance, and in depth it is reported to be nearly vertical, though still to the northwest. This phenomenon is undoubtedly to be ascribed to the dislocating action of alternate frost and heat, augmented by the action of gravity, especially on hill and mountain slopes.[1]

This anomalous dip also applies to the quartz veins at the Boylston mine, as the fissures follow approximately the cleavage planes of the schists.

The schists are cut by a granite dike, the general strike of which is about N. 30° E., dipping apparently at a steep angle. It is a light colored biotite granite of coarse grain, and is largely decomposed to white, kaolinized masses. The width of this dike was not established, but it appears to be over 100 feet in places, and contains large included fragments of the country schists, showing that the age of its intrusion was subsequent to that of the force which rendered the country schistose.

The valley of Boylston Creek is composed of schistose limestone. Along its northwestern boundary, at the base of Forge mountain, this limestone, according to Dr. Wm. B. Phillips,[2] dips to the southeast and is uncomformably overlaid by the schists of the mountain. The limestone outcrop was observed in Woodfin's quarry on the western slope of a low ridge, skirting the eastern bank of Boylston creek. It strikes N. 40° E., and dips 45° S. E., and is overlaid by crumpled schists, which are in part graphitic. These schists contain interlaminated rusty quartz lenses, from ½ to 2 inches in thickness, which carry traces of gold and silver.[3]

The limestone is of a grey blue color, compact, fine crystalline, and apparently quite free from siliceous matter. Some 4 miles further up the valley it is reported to hold thin veins of quartz

[1]On the action of frost in the arrangement of superficial earthy material. By W. C. Kerr, Am. Jour. Sci., III, Vol. 21, May, 1881.
[2]In a private report on the property.
[3]Assayed by Dr. Chas. Baskerville, assistant chemist N. C. Geological Survey.

carrying pyrite, chalcopyrite, galena and blende, though not in commercial quantities. These rocks of the Boylston valley and Forge mountain are in a narrow belt, lately designated as the Ocoee formation by Mr. Arthur Keith of the U. S. Gelogical Survey.

Four main auriferous quartz veins have been discovered on the Boylston property. They are parallel and strike N. 30° E., dipping to the northwest at angles varying from 25° to 75°, their upper portion or crest being deflected down hill, as already mentioned.

In places the quartz is deeply corrugated, and has a banded structure, as though it were folded like the enclosing schists. At the same time it contains included fragments of the schist, and hence the age of its deposition is later than that of the schistosity. This crumpled, quasi-schistose structure of the quartz must therefore be due to other causes, and the most reasonable one appears to be that during deposition the inside layer, next to the wall of the fissure, was moulded on the crumpled schists, and the next succeeding layer was moulded on the first, and so on, producing casts of each other.

The character of the quartz is usually crypto-crystalline, vitreous, being cellular and stained brown above the water level. Rarely it is fine grained, saccharoidal and milky.

The thickness of the veins varies from 1 to 4½ feet. A pay streak, from 1 to 8 inches wide usually appears along the hanging wall. The quartz carries free gold in the upper levels and free gold and sulphurets (pyrite and some galena) below the water level.

For the convenience of description the veins have been numbered 1, 2, 3, and 4, beginning with the one nearest the eastern base of the mountain.

The occurrence of gold in Boylston creek was known for a long time, but it was not until the winter 1885-1886 that the quartz veins of Forge mountain were prospected by Mr. Wm. Allison. He worked the soft, decomposed outcrop of vein No. 2, by sluicing and washing, with good results. Explorations proved so favorable that the present company was formed in 1886, and

machinery was erected for treating the ores. The mine was then operated spasmodically and with varying success. In the fall of 1889, Dr. Wm. B. Phillips made a thorough examination of the property, with practical mill tests of the ores, the results of which were presented in a report to the company.

The mine is now idle and at the time when visited by the Survey (October, 1894), most of the openings were caved in and inaccessible. Much of the matter, including assays, contained in the following description of the Boylston mine, has been taken from the detailed report of Dr. Phillips.

Vein No. 1 is exposed in a small pit, now caved in, near the eastern base of Forge mountain. Its width at this point is stated to be 2½ feet, with a 2½ inch seam of slaty material. The quartz is saccharoidal and stained brown. An assay, representing the width of the vein, excluding the slaty seam, shows:

Assay, Gold Ores, Vein No. 1, *Boylston Mine, Henderson County.*

	(311)
Gold, per ton	$4.13
Silver, "	50
	$4.63

On the Frank Sitton land, adjoining the Boylston property on the northeast, the same vein has been explored in a shaft 30 feet deep, and an open-cut 25 by 5 by 5 feet. The thickness of the vein is reported to be 3 feet. Two assays show:

Assays, Gold Ore, Boylston Vein No. 1, *Sitton Property, Henderson County.*

	(312)	(313)
Gold, per ton	$ 13.37	$13.44
Silver, per ton	.41	.60
	$ 13.78	$14.04

Vein No. 2 has been more thoroughly prospected and developed than the others. All of the ore that has been mined and milled at the Boylston was obtained from this vein.

The principal work on No. 2 begins at the George Sitton branch (Allison opening), and extends thence in a northeasterly direction along the outcrop in a series of open cuts made at intervals over a length of about 1500 feet, to the Mill branch, and thence in a series of drifts, for a distance of 300 feet.

The Allison opening extends from the George Sitton to Rail Cove branch, a distance of about 600 feet. It is an open cut,

averaging 10 feet in width and 15 feet in depth. In this distance are situated two shafts and an inclined tunnel, namely the Garwood and Radford shafts, and the Allen slope. In the open cut the vein is from 3 to 4 feet thick, composed of decomposed sulphurets and sugary quartz. A rich pay-streak of reddish brown quartz forms a layer, from 1 to 3 inches thick, next to the hanging wall, generally; but it is not to be depended on as regards either thickness or linear extent. In the sulphurets, composed chiefly of pyrite and some little chalcopyrite, about one-third of the gold is free.

The Garwood shaft is 25 feet deep, and the thickness of the vein here is stated to be 4½ feet. At the bottom of the shaft the Thomas level extends 35 feet, S. 15° W.

The Allen slope is 25 feet long. The Radford shaft is 20 feet deep; the vein is 3 feet thick, and dips 65° N. W. The granite dike appears in the hanging wall, 4 feet from the vein.

A number of assays show:

Assays, Gold Ores, Vein No. 2, Allison Opening, Boylston Mine, Henderson County.

	(314)	(315)	(316)	(317)	(318)	(319)	(320)	(321)	(322)
Gold, per ton	$7.23	$4.13	$4.13	$5.18	$6.20	$7.23	$109.35	$84 75	$7 23
Silver, per ton	.41	.41	.50	.50	.65	.50	4.04	3.87	.75
	$7 64	$4.54	$4.63	$5.68	$6.85	$7.73	$113.39	$88.62	$7.98

314. Quartz from open cut. 315. Sulphurets from Allen slope. 316. Sugary quarz from open cut. 317. Ore from mill dump. 318. Ore from mill dump, one-half Garwood shaft. 319. Quartz from Garwood shaft. 320 and 321. Reddish brown ore from pay streak. 322. Outcrop of sulphurets in branch.

Dr. Phillips estimates that 1,000 tons of ore have have been taken from this part of the mine—between the Geo. Sitton and Rail Cove branches—and that the amount of ore still remaining above the water level is about 2000 tons, which may be depended on to yield $4.00 per ton in free gold (assay value). He gives as the cost of mining, transportation and milling, $2.25 per ton.

The Winny Dunkin opening begins on the north side of Rail Cove branch, and extends as an open cut N. 15° E., for a distance of 275 feet. It is 10 to 15 feet in width, and about the same in depth. Sulphurets appear here 20 feet from the surface. In the zone above the sulphurets the vein matter is composed of granular quartz, decomposed sulphurets, slate with seams of quartz, and segregated thin seams of rusty quartz, carrying coarse gold. A section from foot to hanging walls, 10 feet below the surface, is given as follows:

	Feet.	Inches.
Rusty brown slate, with seams of quartz	0	6
Rusty quartz, carrying coarse gold	1	0
Milky quartz, somewhat cellular and rusty	1	6
Thin bands of brown slate, highly silicified	1	6
	4	6

Some assays from the Dunkin opening show:

Assays, Gold Ores, Vein No. 2, Dunkin Opening, Boylston Mine, Henderson County.

	(323)	(324)
Gold, per ton	$ 4.13	$ 4 13
Silver, per ton	5.48	.50
	$ 9.61	$ 4.63

322. Sulphurets; the high silver is due to the galena present. 323. Ore from cut, 15 feet below the surface, sampled across the vein from wall to wall.

It is estimated that 300 tons of ore were removed from this opening, and that the amount of free milling ore still remaining above the water level between Rail Cove and Mill branches is 4100 tons, which will yield $4.00 per ton, (assay value.)

Immediately on the north side of Mill branch is a series of seven drifts, now in very bad condition, along the outcrop of vein No. 2, for a distance of 300 feet.

Their relative positions are shown in fig. 17.

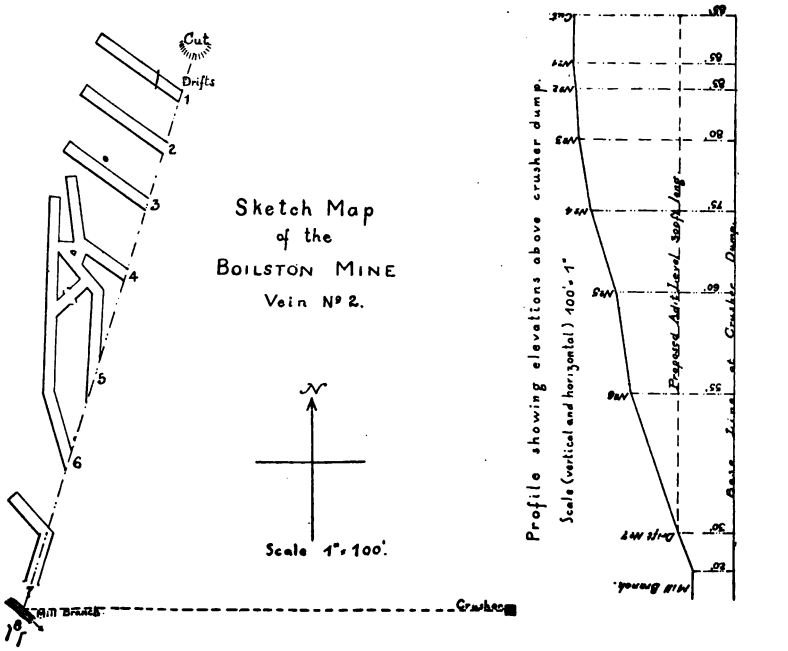


FIG. 17 Drifts 1 to 8 inclusive, Vein No. 2, Boylston Mine.

On the south side of the branch is drift No. 8, 50 feet long. The granite dike was penetrated by it, and the thickness of the quartz vein is 3 feet. An assay shows.

Assay, Gold Ore, Drift No. 8, Boylston Mine, Henderson County.

(325)

Gold, per ton	$ 4.13
Silver, per ton	.40
	$ 4.53

Drift No. 7 follows the pay streak, which is 3 to 6 inches thick, along the hanging. The width of the vein is 4 feet, filled with stained granular quartz. It is accompanied by the granite dike. An assay shows:

Assay, Gold Ore, Drift No. 7, Boylston Mine, Henderson County.

(326)

Gold, per ton	$23.77
Silver, per ton	1.70
	$25.47

It is estimated that 60 tons of ore have been removed from here.

Drift No. 6 joins No. 5 by a cross cut. It shows 2 feet of sugary quartz, stained brown. The amount of ore removed from here is estimated at 60 tons.

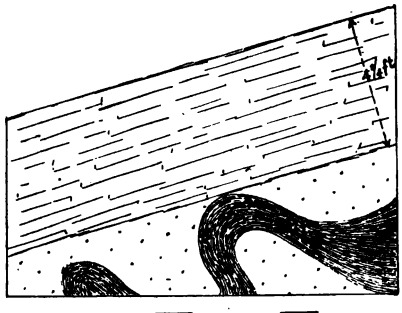


Fig. 18. Section on the dip of the vein at mouth of Drift No. 5. (See also fig. 17, p. 187.)

Drift No. 5 opens on a platform at the top of an incline, 200 feet long, to the crusher dump. At its mouth the thickness of the quartz vein measured 4½ feet. The highly crumpled and folded schists make their appearance on the foot wall side, and are broken through by the eruptive granite, as shown in Fig. 18, from the Boylston mine.

Drift No. 4 exposes on the outcrop 4 feet of quartz, separated by 1 foot of granite. The vein swells and pinches, and appears to be cut off at one point by the crumpled schist. Near the face of the opening the vein matter consists of the schist itself, highly impregnated with quartz stringers and stained brown. This is best illustrated in Fig. 19.

It is estimated that 50 tons have been removed from here.

Drift No. 3: The vein is probably 3 feet thick and dips 25° N. W. About 10 tons of ore have been removed.

Drifts Nos. 1 and 2 show up similarly to No. 3. About 10 tons of ore have been removed from each.

Some 20 feet beyond the mouth of Drift No. 1 is the face of the Upper Cut, the termination of the work that has been done on this part of vein No. 2. It is on this ridge that the vein appears to have been most disturbed by the granite dike, which lies next to the foot wall, and carries some free gold. An assay of the three feet adjoining the foot wall shows:

Fig. 19. Showing section on dip of vein in Drift No. 4, Boylston Mine.

Assay, Gold Ore, Vein No. 2, Boylston Mine, Henderson County.

	(327)
Gold, per ton	$ 2.06
Silver, per ton	.50
	$ 2.56

Some assays of the ore from these drifts show:

Assays, Gold Ore, Drifts 1—7, *Boylston Mine, Henderson County.*

	(328)	(329)	(330)	(331)	(332)	(333)	(334)
Gold per ton,	$ 8.47	$ 8.27	$18.09	$55.30	$ 4.13	$ 5.17	$ 5.18
Silver "	.62	.50	1.01	3.44	.50	.41	.41
	$9.09	$8.77	$19.10	$58.74	$4.63	$5.58	$5.59

	(335)	(336)	(337)	(338)
Gold, per ton	$ 6.20	$ 6.20	$ 4.13	$ 11.37
Silver, per ton	.50	.32	.50	.58
	$ 6.70	$ 6.52	$ 4.63	$ 11.95

Assay No. 328, Sample was taken from pay streak, 8 inches wide, from drift No. 1.
Sample 329, From 8 inches of soft ore, immediately above the pay streak in drift No. 1.
330. Reddish brown pay streak, 8 inches wide, in drift No. 2.
331. Pay streak, 6 inches wide, in drift No. 3.
332. Sample across the face of 3½ foot vein, drift No. 3.
333. Quartzose slate, 12 inches thick, drift No. 3.
334. Mill dump, ⅔ soft, ⅓ hard ore.
335. Mill dump, soft ore.
336. Mill dump, soft ore from above mill.
337. Isolated mass of sulphurets in drift No. 3.
338. From outcrop, 2½ feet thick, where vein No. 2 crosses high top of Forge mountain.

Vein No. 3 has been prospected in a small pit and drift near the head of Rail Cove branch. The thickness is stated to be 2½ feet, and the vein matter is composed of granular quartz, rusty cellular quartz, quartzose slate, and some pyrite. Several assays show:

Assays, Gold Ores, Vein No. 3, *Boylston Mine, Henderson County.*

	(339)	(340)
Gold, per ton	$ 18.60	$ 34.11
Silver, per ton	.32	.82
	$ 18.92	$ 34.93

339. Sampled across face of vein. 340. Six inch seam of rusty quartz.

Vein No. 4 has been exposed on Vineyard branch, near the summit of the mountain, in a small pit, 6 feet deep. Its thickness is stated to be 3 feet, and the strike and dip are similar to those of the other veins. The ore is granular quartz. An assay of a sample taken across the face shows:

Assay, Gold Ore, Vein No. 4, *Boylston Mine, Henderson County.*

	(341)
Gold, per ton	$ 3.10
Silver, per ton	.56
	$ 3.66

A summary statement of the work done by Dr. Phillips in September, 1889, including mining and milling, is as follows:

	Allison Opening.	Winney Dunkin Opening.	Drifts 1. 2 and 3.
No. of tons mined.....	10	25	40
Assay value.....	$5 56	$4.51	$5.49
Cost of mining and transportation.....	$1.50	$1.25	$1.17

The total amount of ore mined and milled was 75 tons, worth $387.95, calculated from the above statement. The amount recovered was $112.20, an extraction of 24.63 per cent. of the assay value. This low yield was in general measure due to the condition of the machinery and outside battery plates; the 75 tons required 348 hours for running through, and during the last 72 hours one-third of the total amount of gold saved, was obtained, although the assay value of the ore remained the same. In other words, 20.8 per cent. of the time gave 33.3 per cent. of the gold, *after* the mill had been brought up to something like its proper efficiency. The rate of milling per day (24 hours) was 5.17 tons; no more than this could be treated owing to the condition of the crusher, the shoes and dies, and the belts.

The mill, if in proper condition, should be capable of treating at least 10 tons per day, with a saving of 60 per cent. of the assay value.

Excluding the interest on the investment, Dr. Phillips estimates the cost of mining, transportation and milling at $2.33 per ton, on a basis of 375 tons per month.

JACKSON, TRANSYLVANIA AND MACON COUNTIES.

The gold of Jackson county has been obtained almost entirely from placers or detrital beds. These are situated chiefly along the southern slopes of the Blue Ridge, near Hogback and Chimney Top mountains.

The most important locality is Fairfield valley, where Georgetown creek, one of the head streams of the Toxaway, is said to have

yielded between two and three hundred thousand dollars. The deposits extend for several miles along these elevated basins, and have been by no means exhausted. The origin of the gold here is doubtless to be sought in the quartz veins of the Blue Ridge, which rises on the north and east—a precipitous wall of gray gneiss—to a height of 700 or 800 feet above the valley. It is along the base of this wall, where Georgetown creek has cut a deep channel, that the gold has been principally obtained.

The deposits in Transylvania county, east of the Blue Ridge, on the headwaters of the French Broad, will probably be found to have a similar origin, and are evidently a continuation of the same belt of deposits.

In the southeast corner of Macon county, in Whitener's valley and Horse cove, mining for gold has been carried on to a limited extent in the stream deposits.

CHEROKEE COUNTY.

Possibly twenty-five to fifty men may be employed in actual mining operations in this county, working some half a dozen placers.

The gold obtained is mostly in the form of large grains and nuggets. The greater part thus far won appears to have come from the valleys of Valley river and its transverse tributary streams. The immediate source of this gold is four fold: (1) The gravel underlying the broad bottoms of Valley river and other streams; (2) The schists and the included quartz stringers or veins of the more elevated country bordering these valleys. (3) The iron ore beds, which skirt Valley river along its whole length, and occur with several reduplications or foldings at intervals for several miles to the east;[1] (4) The limestone (marble), which is usually closely associated with the iron ore beds, and contains gold in connection with galenite and possibly also in quartz veins, that traverse it.

These rocks have lately been referred to the Ocoee by the U. S. Geological Survey.

[1]For an account of these ore beds, see Bulletin No. 1, Geological Survey of N. C.: The Iron Ores of North Carolina, p. 196 et. seq.

The placer mines now worked are situated in the drift which covers the spurs and terminal ridges, especially where they project into the bottom land. Ditches are constructed to bring the water from the upper reaches of the mountain streams, under a sufficient head to operate at the desired points. The drift beds have a depth of 10 to 20 feet, and are occasionally at a considerable elevation above the river.

The schists have not been largely prospected, and cannot be utilized without heavy stamping machinery, as, owing to the steepness of the hills and mountains all the soft and altered material has been cleaned off by denudation. The unaltered schists are more costly to mine and treat, and would require the closest and most economical management; there is abundant evidence, however, that considerable work of this nature has been done on the hill and mountain sides. There are no data in possession of the survey defining the width and extent of the gold bearing schists, nor the number of such zones.

The iron ore (limonite) beds have not hitherto been regarded generally as gold bearing, but some examinations point to a presumption that they are frequently auriferous. Assays of a number of samples ran from $1.86 to $10.60 per ton. The possibilities in this direction deserve further examination.

Gold also occurs in the marble in association with galenite. Such localities are: Section No. 6, 1 mile northeast from Murphy; at Axel's shaft near Marble creek, 3½ miles northeast of Murphy; and near Marble post office.

Some samples of the ores from Section No. 6 gave the following assay values:

Assays, Gold Ores, Section No. 6, Cherokee County.

	(342)	(343)	(344)
Gold, per ton	$ 7.03	$ 13.02	$ 14.88
Silver, "	trace	.10	19.20
	$7.03	$13.12	$34.08

So little attention has been given to these occurrences that the extent of the resources is practically unknown, but they certainly appear to be worthy of more thorough exploration.

INDEX.